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3rd Edition of

EUROPEAN LASERS, PHOTONICS AND OPTICS TECHNOLOGIES SUMMIT

SEPT 2023

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VIRTUAL EVENT

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BOOK OF ABSTRACTS

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EUROPEAN LASERS, PHOTONICS AND OPTICS TECHNOLOGIES SUMMIT

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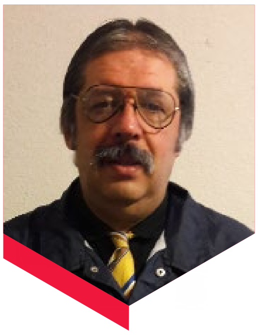


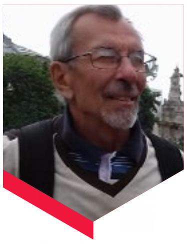
Francisco Bulnes
IINAMEI, Mexico

Thomas J Webster
Interstellar Therapeutics, China

Vladimir G Chigrinov
Hong Kong University of Science and Technology, Hong Kong

Thank You All...

Speakers



Almas Sadreev
L.V. Kirensky Institute of Physics, Russian Federation

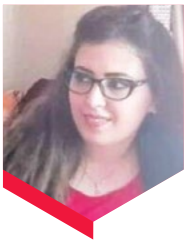
Apurva Kumari Singh
B V Raju Institute of Technology, India

Ben Campbell Biezanek
Distinguished Researcher, United Kingdom

Byeong Hoon Park
Pohang University of Science & Technology, Korea, Republic of

Carlos A Hernandez Gutierrez
Ecnologico Nacional de Mexico Campus Tuxtla, Mexico

Erol Sancaktar
University of Akron, United States



Fatima Zahra Siyouri
Mohamed V University, Morocco

Frederick H Silver
Rutgers, United States

Jingjing Guo
Beihang University, China

Mayur Kumar Chhipa
ISBAT University, Uganda

Meera Ramrakhiami
Rani Durgavati University, India

Mojtaba Ahmadieh Khanesar
University of Nottingham, United Kingdom

Moumita Das
Malda College, India

Nikolai Kosarev
Siberian Federal University, Russian Federation

Reinhold Noe
Paderborn University, Germany

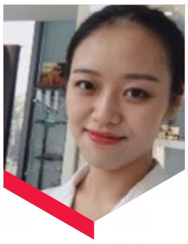
Robert Buenker
University of Wuppertal, United States

Speakers

Valentyn Nastasenko
Kherson State Maritime Academy, Ukraine

Vladimir Koltsov
Khlopin Radium Institute, Russian Federation

Xin Chen
Xidian University, China



Yue Feng
University in Tromso, Norway

Welcome Message

Dear ladies and gentleman, researchers, scientists and technologists, it is an honor and pleasure to write a few welcome notes. Optics and photonics are part of the emerging technologies that are being fundamentals in the future, thus require more deep research and knowledge on quantum electrodynamics and spintronics among others. I think that the ELOS23, is an international conference dedicated to impulse and spreading of all areas and scopes inside optics and photonics and related areas that require more research and support in the universities and research departments in careers of electronics engineering, electrical engineering and communications engineering, considering that in the next one hundred years, with the advance in quantum computing, will be these study areas the that will play a primordial role in all technological developments and beyond, to the surviving of the human race in the Earth and the Universe.

PROF. DR. FRANCISCO BULNES

CHALCO, MEXICO

ABOUT
MAGNUS GROUP

Magnus Group (MG) is initiated to meet a need and to pursue collective goals of the scientific community specifically focusing in the field of Sciences, Engineering and technology to endorse exchanging of the ideas & knowledge which facilitate the collaboration between the scientists, academicians and researchers of same field or interdisciplinary research. Magnus Group is proficient in organizing conferences, meetings, seminars and workshops with the ingenious and peerless speakers throughout the world providing you and your organization with broad range of networking opportunities to globalize your research and create your own identity. Our conferences and workshops can be well titled as 'ocean of knowledge' where you can sail your boat and pick the pearls, leading the way for innovative research and strategies empowering the strength by overwhelming the complications associated with in the respective fields.

Participation from 90 different countries and 1090 different Universities have contributed to the success of our conferences. Our first International Conference was organized on Oncology and Radiology (ICOR) in Dubai, UAE. Our conferences usually run for 2-3 days completely covering Keynote & Oral sessions along with workshops and poster presentations. Our organization runs promptly with dedicated and proficient employees' managing different conferences throughout the world, without compromising service and quality.

ABOUT
ELOS 2023

Magnus Group is excited to announce the upcoming "3rd Edition of European Lasers, Photonics, and Optics Technologies Summit" (ELOS 2023), which will be held as a virtual event from September 25 to 27, 2023. This event will cover a broad spectrum of optics, photonics, and lasers, offering a distinctive platform for the exchange of ideas and the presentation of the latest advancements in these fields. ELOS 2023 will center around the theme, "Eyeing Progressions and gathering insights in Lasers, Photonics, and Optics Technologies," with a focus on exploring significant breakthroughs and developments in optics, photonics, lasers, and their practical applications.

The primary goal of ELOS 2023 is to assemble a multidisciplinary gathering of scholars and industry professionals from around the world to facilitate the exchange of groundbreaking ideas in the fields of lasers, optics, and photonics. We aim to promote social and technical interaction among these communities, enhancing the quality and global reach of research dialogues while highlighting recent remarkable discoveries in these domains.

With over 30 scientific sessions conducted in an online format, ELOS 2023 presents a unique opportunity for advancing your scientific pursuits, expanding your professional network, and contributing to the future of optics and photonics on a global scale.

BOOK OF ABSTRACTS

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KEYNOTE FORUM

3RD EDITION OF

EUROPEAN LASERS, PHOTONICS AND OPTICS TECHNOLOGIES SUMMIT

Photoaligning and photopatterning for liquid crystal display and photonics devices

Photoalignment and photopatterning has been deproposed and studied for a long time. Light is responsible for the delivery of energy as well as phase and polarization information to materials systems. It was shown that photoalignment liquid crystals by azodye nanolayers could provide high quality alignment of molecules in a Liquid Crystal (LC) cell. Over the past years, a lot of improvements and variations of the photoalignment and photopatterning technology has been made for photonics applications. In particular, the application of this technology to active optical elements in optical signal processing and communications is currently a hot topic in photonics research. Sensors of external electric field, pressure and water and air velocity based on liquid crystal photonics devices can be very helpful for the indicators of the climate change.

We will demonstrate a physical model of photoalignment and photopatterning based on rotational diffusion in solid azodye nanolayers. We will also highlight the new applications of photoalignment and photopatterning in display and photonics such as: (i) fast high resolution LC display devices, such as field sequential color ferroelectric LCD; (ii) LC sensors; (iii) LC lenses; (iv) LC E-paper devices, including electrically and optically rewritable LC E-paper; (v) photo induced semiconductor quantum rods alignment for new LC display applications; (vi)100% polarizers based on photoalignment; (vii) LC smart windows based on photopatterned diffraction structures; (vii) LC antenna elements with a voltage controllable frequency.

Acknowledgements:

1. V.G. Chigrinov, V.M. Kozenkov and H.S. Kwok, Photoalignment of liquid crystalline materials, Wiley, 2008.
2. V.G. Chigrinov, Liquid Crystal Photonics, Nova Science Publishers, 2015.

Vladimir G Chigrinov

Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong

Nanjing Jingcui Optical Technology Co., LTD, Nanjing, China

Biography

Professor Vladimir G. Chigrinov is Professor of Hong Kong University of Science and Technology since 1999. He is an Expert in Flat Panel Technology in Russia, recognized by the World Technology Evaluation Centre, 1994, and SID Fellow since 2008. He is an author of 6 books, 31 reviews and book chapters, about 317 journal papers, more than 668 Conference presentations, and 121 patents and patent applications including 36 US patents in the field of liquid crystals since 1974. He got Excellent Research Award of HKUST School of Engineering in 2012. He obtained Gold Medal and The Best Award in the Invention & Innovation Awards 2014 held at the Malaysia Technology Expo (MTE) 2014, which was hosted in Kuala Lumpur, Malaysia, on 20-22 Feb 2014. He is a Member of EU Academy of Sciences (EUAS) since July 2017. He got A Slottow Owaki Prize of SID in 2018. He is 2019 Distinguished Fellow of IETI (International Engineering and Technology Institute).

Laser fabricated green nanoparticles: The future of medicine

Nanotechnology has already revolutionized numerous applications from alternative energy to electronics to medicine. Unfortunately, many of these nanomaterials are made through the use of toxic catalysts or material fabrication processes which leave a large carbon footprint. This presentation will cover how one can create environmentally friendly nanomaterials using a laser alone and how such materials are improving disease prevention, detection, and therapy. Moreover, laser etching has proven to be an excellent process to create nanotextures on today's implants to promote tissue growth, limit infection, and inhibit inflammation. In fact, this talk will cover human implantation of such nanotextured surfaces and how there have been no failures in over 14,000 cases of implantation. Moreover, this presentation will cover the future of using laser fabricated green nanoparticles across other fields of medicine.

Audience Take Away Notes

- Learn how to make nanoparticles from lasers
- Learn how to make nanotextures from lasers
- Learn how such nanomaterials are being used to improve medicine

Thomas J Webster

Interstellar Therapeutics, Mansfield, MA United States of America 02914

Biography

Thomas J. Webster's (H index: 120; Google Scholar) degrees are in chemical engineering from the University of Pittsburgh (B.S., 1995; USA) and in biomedical engineering from RPI (Ph.D., 2000; USA). He has served as a professor at Purdue (2000-2005), Brown (2005-2012), and Northeastern (2012-2021; serving as Chemical Engineering Department Chair from 2012 - 2019) Universities and has formed over a dozen companies who have numerous FDA approved medical products currently improving human health. He is currently helping those companies and serves as a professor at Hebei University of Technology, Saveetha University, Vellore Institute of Technology, UFPI, and others. Dr. Webster has numerous awards including: 2020, World Top 2% Scientist by Citations (PLOS); 2020, SCOPUS Highly Cited Research (Top 1% Materials Science and Mixed Fields); 2021, Clarivate Top 0.1% Most Influential Researchers (Pharmacology and Toxicology); 2022, Best Materials Science Scientist by Citations (Research.com); and is a fellow of over 8 societies. Prof. Webster is a former President of the U.S. Society For Biomaterials and has over 1,350 publications to his credit with over 53,000 citations. He was recently nominated for the Nobel Prize in Chemistry (2023).

Polaritonic excitations in non-ideal lattices of coupled microcavities containing quantum dots

Vladimir V Rumyantsev[1,2], Konstantyn V Gumennyk[1], Ales Mishchenko[1]*, Alexey Rybalka[1]

[1]Department of Theory of Complex Systems Dynamic Properties, A.A. Galkin Institute for Physics and Engineering, Donetsk, Ukraine

[2]Mediterranean Institute of Fundamental Physics, 00047 Marino, Rome, Italy

The advent of optoelectronic devices utilizing various recent advances in photonics such as the harvesting of light by nanophotonic waveguides or quantum information processing has elevated the importance of the correct theoretical understanding of nanocrystalline photonic structures. Recently, a considerable interest has been drawn to crystalline structures known as Lieb lattices. Strong confinement of light in photonic Lieb lattices opens up routes to development of new light-trapping schemes. Among the problems raised by fabrication of novel nanocomposite materials (used as sources of coherent radiation) and by construction of corresponding devices one encounters the necessity of an adequate description of the so-called polaritonic crystals. The latter constitute a special class of photonic crystals featured by a strong coupling between quantum excitations (excitons) and optical fields. Investigations into polaritonic structures have given rise to polaritonics as a separate branch of photonics.

Examples of polariton structures are a spatially periodic system of coupled micro-cavities (resonators), as well as arrays of quantum dots embedded in photonic nanostructures. Recently, there has been a growing interest in optical modes in microcavity lattices with embedded quantum dots. In particular, the authors of this work considered an imperfect photonic crystal, which is a lattice of tunnel-coupled microcavities (resonators) containing atomic nanoclusters (quantum dots). The achievement of a strong connection between a quantum dot and such a microresonator was demonstrated.

The report is devoted to elucidation of the effect of point-like defects on polaritonic excitations dispersion in a 1D array of microcavities (resonators) with embedded one-level quantum dots. It is shown that the presence of vacancies in the microcavity lattice and atomic (quantum dots) subsystems results in a substantial renormalization of polariton spectrum and thus in a considerable alteration of optical properties of the structure. Introduction of defects leads to an increase in the effective masses of polaritons and hence to a decrease of their group velocity.

Our model is primarily based on the virtual crystal approximation, which is often employed to examine quasiparticle excitations in sufficiently simple disordered superstructures. More complex systems usually require the use of more sophisticated methods such as the (one- or multinode) coherent potential approximation, the averaged T-matrix method and their various modifications.

The obtained numerical results help to obtain new composite polariton structures and expand the prospects for their use in the construction of solid-state devices with controlled propagation of electromagnetic excitations.

Audience Take Away Notes

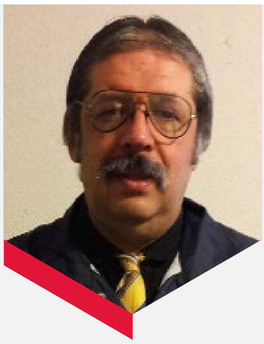
- The result presented in the paper is of interest to both researchers and teachers, since it introduces the audience to a new section of photonics – polaritonics
- The work introduces the audience to the use of numerical simulation of polariton dispersion based on the virtual crystal approximation
- Among the problems raised by fabrication of novel nanocomposite materials (used as sources of coherent radiation) and by construction of corresponding devices one encounters the necessity of an adequate description of the so-called polaritonic crystals
- The obtained results help to obtain new composite polariton structures and expand the prospects for their use in the construction of solid-state devices with controlled propagation of electromagnetic excitations

Fermion derived products from an electromagnetic plasma reactor

Studies on the electromagnetic plasma have demonstrated the existence of derived products from electromagnetic plasma as are phonons, fermions, ions, free electrons and protons, magnetic and electric drifts, producing an ionic force that could be used as propulsion force. Experimentally and considering direct current and voltage in a constant regime, has been detected as ionic wind which carries fermion products to be used in a possible propulsion of ionic type. This raises another way for electromagnetic propulsion proposed in many works. Likewise through a caption and detection camera, are measured the electromagnetic properties of the ionic flow of the space $\sim II(\rho,\upsilon)$, derived from the electromagnetic plasma $\sim IIH$ Therefore is proposed an ionic propeller considering the pressure gradients due to electrons and ions concentrated in a little region of shock waves produced with an electric field. The mean curvature energy is used to measure and control the ionic flow.

Audience Take Away Notes

- The immediately applications will can be useful in the following developments of the reactors by plasma
- This research that other faculty could use to expand their research or teaching
- Likewise this focused to the advanced navigation and astronautics engineering
- The research has new fundamentals and high prospective
- Extend and induce the plasma and MHD theories, and consider new aspects and contributions



Francisco Bulnes

Research Department in Mathematics and Engineering/ TESCHA/IINAMEI, Chalco, State of Mexico, Mexico

Biography

PhD in Mathematical Sciences, IM/UNAM. IINAMEI Director, Mathematics Research Centre in Mexico, 2015- Actually. Pioneer of several theories like curvature energy theory among others. Editor-in-Chief of Journals of Mathematics. Numerous papers (more than 130) in journals, and author/editor of much books of mathematics and physics. Famous in East Europe, Asia, Arab continents. He has many theories, theorems, math objects with his name. He has received various honors and awards (Doctorates Honoris Causa) by universities and NGO's, likewise GO's. He has two post-doctorates in Cuba and Russia in mathematics. More than 70 international awards and badges. His biography has been published in many books of the United Kingdom, India, China, Russia, Ukraine, USA, Spain and Mexico.

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SPEAKERS

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B H Park*, O'Dae Kwon, K S Yoon, J S Lee

Department of Electrical & Electronics Engineering, Pohang University of Science & Technology, Pohang, Korea

Non-invasive infrared diagnoses, via angle-coherent tomographic infrared spectroscopy, realized via 3D photonic quantum ring laser

Non-invasive infrared diagnoses employing 3-Dimensional (3D) Angle-Resolved Light Cones (ALCs) from 3D Photonic Quantum Ring (PQR) are explained for Angle-Resolved Coherent Tomographic Infrared Spectroscopy (ACTIRS).

Audience Take Away Notes

- The detailed 3D analysis follows when we understand helical standing wave propagations CW and CCW within a resonant toroidal cavity. The 3D PQR characteristics with ultra-low threshold current, in contrast to the usual 1D/2D lasers, then follow when the recombinant 2D carriers are mostly confined to the 2D quantum well plane which constructs concentric 1D quantum rings of half-wavelength intervals in spontaneous formation within the 2D peripheral Rayleigh active region
- The key property of the PQR laser is the conformal 3D features while it presents typical radial angle-resolved blue-shifts. These features generate particular inclination angles of 3D PQR laser radiation creating conformal ALCs with distinct path-dependent blue-shifts through the human organs

Biography

Dr. B. H. Park studied Electronic Engineering at the Gyeongbuk National University, Korea until 1995. He then received his PhD degree in 2002, and M.S. in 1997 at the Pohang University of Science & Technology. He joined Samsung Electronics Co, Ltd., where he has focused on the commercialization of optical devices, such as DFB, EML, and VCSEL as well as blue laser diode and LED. His recent research topic is developing 3D depth sensors for mobile applications. He has published more than over 20 research articles in SCI (E) journals with 100 citations.

Jingjing Guo*, Ce Shang
School of Instrumentation and Optoelectronic Engineering, Beihang University, Beijing 100191, China

Nanocomposite optical tactile sensor for health care and human-machine interface

Tactile sensors capable of quantifying mechanical stimuli through physical contact play a pivotal role in healthcare, prosthetics and humanoid robotics. To enable conformal contact with objects of different surface morphologies, tactile sensors with high mechanical flexibility have been extensively explored. Despite recent advances, most of the currently available flexible tactile sensors are based on electrical properties of functional materials, which often suffer from intrinsic limitations such as hysteresis, parasitic effects, signal crosstalk, and electromagnetic interference. In this work, we present a flexible optical tactile sensor by harnessing the unique optical properties of a soft and plasmonic optical fiber, which is made from composites of Gold Nanoparticles (GNPs) and elastomers. The tactile sensor is constructed by assembling the nanocomposite fiber in a sandwich structure, where sensitive and instantaneous sensing of contact force with high precision, low hysteresis, and tunable sensitivity is achieved by transducing mechanical stimuli into interpretable light signals. As demonstrations of its potential, the tactile sensor is utilized for real-time monitoring of blood pressure, respiration, as well as providing tactile mapping of hand motions such as tapping, shaking, and grasping. To further verify the feasibility of mimicking tactile perception of human skin, the proposed sensors integrated onto a robot hand are also demonstrated to perceive material hardness, surface roughness and shape of objects.

Audience Take Away Notes

- The optical tactile sensor was made in an all-elastomer sandwich structure assembled with a partially gold nanoparticle-doped PDMS optical fiber. Benefiting from the all-elastomer design, the proposed sensor was intrinsically flexible and stretchable that enabled conformal contact and tactile measurement on complex curved surfaces
- Taking advantages of the intense Localized Surface Plasmon Resonance (LSPR) effect and low elastic modulus of the plasmonic fiber, the tactile sensors can detect contact force over a wide working range with tuned sensitivity
- We demonstrated the broad applications of the proposed tactile sensor in real-time monitoring of subtle arterial blood pressure, respiration, as well as providing tactile mapping of hand gestures with simultaneous haptic force feedback

Biography

Jingjing Guo, PhD, Associated Professor in the School of Instrumentation and Optoelectronic Engineering at Beihang University. He received his PhD degree in Optical Engineering from Tsinghua University in 2018. His research interests include flexible optical devices, fiber-optic sensors and fiber lasers. He has published more than 20 peer reviewed papers in Advanced Materials, Advanced Functional Materials, Optica, etc. His published works have been selected as research highlights by MIT News, OSA Optics & Photonics News, Newsweek, Fox News, Laser Focus World, etc.

Wei Liu*, Shiwei Yuan, Xiaoya Fan
School of Microelectronics, Northwestern Polytechnical University, Xi'an, Shaanxi, China

Investigation on GaN/AlGaN ultraviolet light-emitting diodes with different thickness of first AlgaN barrier layer

The influence of thickness of the first AlGaN barrier layer, which is closest to the n-type GaN layer, on the luminescence characteristics of ultraviolet GaN/AlGaN Multiple-Quantum-Well (MQW) Light-Emitting Diodes (LEDs) is investigated numerically. Generally, for the study on the transport of carriers in GaN-based multiple-quantum-well Ultraviolet (UV) Light-Emitting Diodes (LEDs), most researches focus on the structure of electron blocking layer (EBL) near p-GaN region, since the leakage of electrons is commonly considered as the main problem in UV LEDs. However, it's found that the luminescence efficiency of LED is enhanced as the thickness of first AlGaN barrier increases. According to the energy band structures and carrier distributions in the MQW active region, it is found that the hole leakage can be suppressed by the thicker first barrier, which may be ascribed to the increased width and height of the triangular potential barrier induced by the polarization electric field in the first AlGaN barrier layer in Figure 1. Therefore, the concentration of holes in the whole MQW active region is increased, which improves the luminescence efficiency of the ultraviolet LEDs with thick AlGaN first barrier layer.

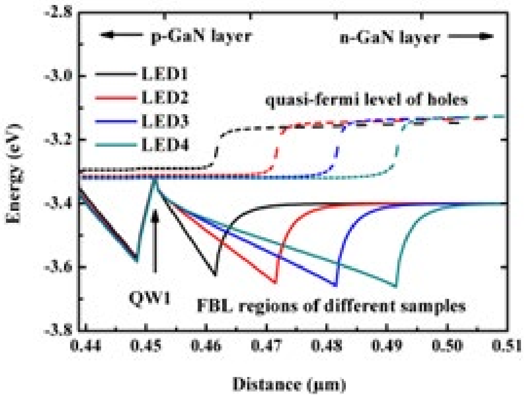


Fig. 1 Schematic diagram of the effect of first barrier layer on the energy bands at 2-mA injection current for all.

Audience Take Away Notes

- The audience will know better about the working mechanisms of GaN-based ultraviolet light-emitting diodes
- My presentation provides a simple and practical solution to improve the performance of ultraviolet light-emitting diodes
- Other faculty can use our conclusion to expand their research or teaching

Biography

Dr. Wei Liu is currently an Associate Professor with the School of Microelectronics, Northwestern Polytechnical University, Xi'an, China. His current research interest is the study on the group III-V compound semiconductors for optoelectronic materials and devices, such as avalanche photodiodes and light-emitting diodes.

Xin Chen[1]*, Chunsheng Xu[1], Shan Liu[2], Dawei Liu[2], Junli Wang, Yan Sheng[2], Wieslaw Krolikowski[2]

[1]Department of Optical Information Science and Technology, School of Physics and Optoelectronics Engineering, Xidian University, Xi'an, China

[2]Department of Quantum Science and Technology, Research School of Physics, Australian National University, Canberra, Australia

Laser direct writing of nonlinear photonic crystals and their applications in nonlinear frequency conversion

Artificial microstructures with periodic modulation of second-order nonlinear susceptibility □(2), also known as Nonlinear Photonic Crystals (NPCs), can compensate phase mismatch in nonlinear optical frequency conversion process by providing additional reciprocal lattice vectors. This Quasi-Phase Matching (QPM) technique thus facilitates efficient nonlinear frequency conversion. Owing to the ability to generate and manipulate light fields at new frequencies, NPCs are widely utilized in fields such as nonlinear optics and quantum information processing. The most prevalent type of NPC is a periodic domain structure in a ferroelectric material, which is typically fabricated by applying an external electric field through patterned electrodes. However, this electric field poling scheme lacks flexibility and is incapable of producing three-dimensional NPCs.

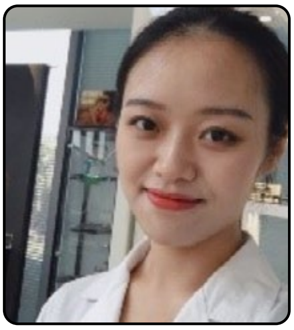
A potential solution is to use light field to define domain structures instead of physical electrodes. Recent advancements have been made through direct reversal of ferroelectric domains using focused femtosecond laser pulses, leading to a breakthrough in the experimental fabrication of three-dimensional NPCs. This presentation will begin by briefly introduce the fundamentals of quadratic nonlinear optics, including phase mismatch, QPM and NPCs. Then the common fabrication and characterization methods of NPCs will be given and compared. Subsequently, the research progress and working principles of laser directly written NPCs will be reviewed and discussed. Several application examples will be provided, including domain induction and erasure in $PbTiO_3$ based relaxor ferroelectric crystals, three-dimensional nonlinear optical frequency conversion and nonlinear beam shaping using NPCs. Finally, the challenges faced by this laser poling technology, the future developments and potential applications will be discussed.

Audience Take Away Notes

- The audience will gain an understanding of the fundamental principles and research advancements in the field of laser induced ferroelectric domain inversion
- The laser poling technique presented in this talk provides a practical solution to fabricate three-dimensional ferroelectric domain structures, which is beyond the capacity of other fabrication scheme like electric field poling
- The laser poling technique, together with laser erasure technique, can improve the fabrication accuracy and obtain nanodomain structures
- The optically poled three-dimensional domain structures can be served as nonlinear photonic crystals and piezoelectric phononic crystals, which can be used in fields including nonlinear optics and acoustics

Biography

Dr. Xin Chen studied Materials Physics and Chemistry at South China Normal University, China and graduated as ME in 2013. He then joined the research group of Prof. Wieslaw Krolikowski at Research School of Physics and Engineering (RSPE, now renamed as RSP), Australian National University (ANU). He received his PhD degree in 2018 at the same university. He then obtained the position of an Associate Professor at Xidian University, China. He has published more than 20 research articles in SCI (E) journals.



Yue Feng[1]*, Aleksandar Stojanovic[2,3]

[1]Institute of Community Medicine, Faculty of Health Sciences, University in Tromso, Norway

[2]Department of Ophthalmology, University Hospital North Norway, Tromso, Norway

[3]Institute of Clinical Medicine, Faculty of Health Sciences, University in Tromso, Norway

Repeatability and agreement of total corneal astigmatism measured in keratoconic eyes using four current devices

Purpose: To evaluate repeatability and agreement of measurements of Total Corneal Astigmatism (TCA) in keratoconic (KC) eyes, obtained by two Swept-Source (SS) Optical Coherence Tomography (OCT)-based devices (Anterion and Casia SS-1000), one SS-OCT combined with reflectometry (IOLMaster 700) and one Spectral-Domain (SD) OCT combined with Placido imaging (MS-39).

Methods: Three consecutive measurements were acquired with each of the four devices in 136 eyes. TCA values were transformed into power vector components (J0/J45). The acquisitions from the Anterion and the IOLMaster 700 also provided Axial Length (AL) measurements. The repeatability was calculated using pooled within-subject Standard Deviation (Sw). The agreement between the four devices was assessed by Repeated-measures ANOVA, Bland–Altman plots, and Double-angle plots for vector difference in astigmatism.

Results: The repeatability of TCA measurements showed Sw ≤ 0.23 D for cylinder magnitude, ≤ 0.14 D for J0, and ≤ 0.12 D for J45, for all four devices. There were statistically significant differences in cylinder magnitude for each pair, except when comparing IOLMaster 700 to MS-39 and Anterion to MS-39. There were no statistically significant differences in J45 for any pairs, but there were statistically significant differences in J0 when comparing Anterion to MS-39 and Anterion to MS-39. The smallest mean magnitude of vector difference in astigmatism was between Anterion and Casia SS-1000 (0.55 ± 0.43 D), while the largest was between Anterion and MS-39 (1.36 ± 1.32 D). Both Anterion and IOLMaster 700 showed high repeatability in AL measurements (Sw: 0.007 mm for Anterion and 0.009 mm for IOLMaster 700). The difference in AL between the two was 0.015 ± 0.033 mm ($p < 0.001$).

Conclusion: All four devices showed good repeatability in measurements of TCA in KC eyes, but there were statistically significant variations in cylinder magnitude. Anterion and IOLMaster 700 showed good repeatability and agreement in AL measurements. Future studies are warranted to evaluate the use of the four devices in refractive procedures.

Audience Take Away Notes

- All four devices showed good repeatability in the measurements of TCA in KC eyes, Anterion being the best
- For the measurements of TCA, the SS-OCT-technology-only devices should not be used interchangeably with SS-OCT combined with telecentric keratometry (Anterion and Casia SS-1000 vs. IOLMaster 700) or with SD-OCT combined Placido devices (Anterion and Casia SS-1000 vs. MS-39)
- Devices using different hybrid technologies (IOLMaster 700 and MS-39) should not be used interchangeably
- For AL measurements, Anterion and IOLMaster 700 showed good repeatability and agreement and may be used interchangeably

Biography

Dr. Yue Feng studied Clinical Medicine at the Chongqing Medical University, China, Ophthalmology at Wenzhou Medical University, China, and graduated as MD in 2019. She then joined the research group of Prof. Stojanovic at the Department of Ophthalmology, University Hospital North Norway, Tromso, Norway. She received her PhD offer in 2020 at Institute of Community Medicine, Faculty of Health Sciences, University in Tromso, Norway. During two and half years' research work, she has participated and given presentations at many international academic conferences such as AAO, ESCRS, ASCRS and EuCornea. She has published nearly 10 research articles in SCI journals.

Reinhold Noe
Paderborn University, EIM-E, Paderborn, Germany
Novoptel GmbH, Paderborn, Germany

Correct optical and universal noise figures

Would one insert squarer + lowpass filter into the linear signal path when measuring the electrical Noise Figure (NF) Fe? Of course not. In line with this, one should no longer insert a direct detection photodiode into the linear signal path when measuring the optical NF.

But the traditional optical noise figure Fpnf (so far called F) of E. Desurvire takes as powers the squares and variances of direct detection photocurrents. These "powers" are proportional to 4th powers of amplitudes (fields). This is in conflict with ~150 years of science and with Fe. Which is defined for a linear system with 2 quadratures and power proportional to squared amplitudes.

The optical in-phase and quadrature noise figure Fo, IQ avoids such contradictions. It is measured with a coherent I&Q receiver which has 2 available quadratures, like an electrical receiver. For an amplifier with high gain one gets the optimum noise figure Fo, IQ = 1, while all prior optical noise figures are equal to 2 in this case. Fe and Fo, IQ have been combined into one universal noise figure FIQ for all frequencies. FIQ is the noise figure. Its limits in optical and electrical domains are Fo, IQ and Fe, respectively.

For homodyne receivers with 1 quadrature, the optical homodyne noise figure Fo, I has been derived. It can also combined with the electrical homodyne noise figure Fe, I into a universal homodyne noise figure FI. While Fo, IQ and Fo, I differ, Fe and Fe, I are identical. All this and the generalized noise figures Ffas and Fase of H. Haus are discussed.

More info is available here:

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Presentation 29.11.2022 https://doi.org/10.1109/JLT.2022.3212936/mm1

https://www.vde.com/resource/blob/2264664/dc0e3c85c8e0cb386cbfa215fe499c4c/noise-figure-and-homodyne-noise-figure-data.pdf

https://www.vde.com/resource/blob/2264668/06253acdbf74d710014e3ab507ac154f/do-propagating-lightwaves-contain-photons--data.pdf

Audience Take Away Notes

- The traditional optical noise figure Fpnf is not a noise figure. It is in conflict with ~150 years of science. If it were a noise figure then power would be proportional to voltage taken to the 4th power. Its minimum value 2 does not reflect the fact that the sensitivity of an ideal optical I&Q receiver remains unchanged when it gets an ideal optical preamplifier. I have derived the correct optical I&Q noise figure Fo, IQ which is conceptually identical with the electrical noise figure Fe. Its minimum value equals 1, corresponding to 0 dB. I have also combined the two into one I&Q noise figure FIQ or simply

F, the noise figure. This is important in the beginning convergence of electrical-THz-optical

- In the convergence of electrical-THz-optical, conflicting Fpnf and Fe would be opposed. The correct Fo,IQ and FIQ = F reconcile optical with electrical. The sooner the practitioners understand that Fpnf is conceptually faulty and the sooner they use the correct Fo,IQ, the better.
- The wrong optical noise figure Fpnf is in ~10000 heads. The sooner the correct optical noise figure Fo, IQ is taught, the better.
- It eliminates the coming quarrel between Fpnf and Fe. In this sense the job becomes more efficient.
- It will, in cases where there are optical and electrical effects.

Biography

Reinhold Noe obtained Dipl.-Ing. (1984) and Dr.-Ing. (1987) degrees in electrical engineering from Technical University of Munich, Germany. 1987-1988 he was with Bellcore, NJ, USA. 1988-1992 he was with Siemens Central R&D in Munich, Germany. Since 1992 he is Professor for Optical Communication and High-Frequency Engineering at Paderborn University in Germany. He has published >300 papers. In 2006 he co-published the first coherent synchronous QPSK transmission with standard DFB lasers, in 2007 with polarization multiplex and electronic polarization control. In 2008 he co-received the Innovation Prize of the Land North-Rhine Westphalia. In 2010 he co-founded Novoptel GmbH.

Robert Buenker
University of Wuppertal, United States of America

The failure of both einstein's space-time theory and his equivalence principle and their resolution by the uniform scaling method

The Lorentz Transformation (LT) makes three predictions which are not consistent with one another: Lorentz-Fitzgerald Length Contraction (FLC), Time Dilation (TD) and light-speed equality for observers in relative motion to one another. The LT also stands in violation of the Law of Causality because it fails to recognize that inertial clocks can never change their rate spontaneously. Einstein's Light-Speed Postulate (LSP) is shown to be unviable by considering a case in which a light source passes by a stationary observer at the same time that it emits a light pulse in the same direction. It is found that, in contradiction to the LSP, that the classical velocity (Galilean) transformation (GVT) is applicable when two observers in relative motion deduce the speed of a light wave.

The Newton-Voigt Transformation (NVT) is consistent with the Law of Causality because it assumes space and time do not mix. The NVT is nonetheless consistent with the Relativistic Velocity Transformation (RVT) and also with Einstein's mass-energy equivalence relation $E=mc^2$. The ratio Q of clock rates for two inertial rest frames S and S' is required input for the NVT. Experimental data obey the Universal Time-dilation Law (UTDL) which states that the measured time Δt obtained by a inertial clock for a given event is inversely proportional to γ(v)=(1-v2c-2)-0.5v, where v is the speed of the clock relative to a specific rest frame referred to as the objective rest frame ORS. The value of Q when the clock of the observer in at rest in S while that of another observer is at rest in the object's rest frame S' is obtained from the UTDL as the ratio γ(v')/γ(v). The Uniform Scaling method considers Q to be a conversion factor between the units of time in the two rest frames. It is found that the conversion factors for all other physical properties are integral multiples of Q. Kinetic scaling of the properties insures that the laws of physics are the same in each inertial frame, as required by the RP. It is also pointed out that Einstein's Equivalence Principle (EP) fails to deduce the experimental fact that the wavelength of light is invariant to changes in gravitational potential. The Universal Scaling method uses a set of conversion factors for the effects of gravity that is analogous to those for kinetic scaling.

Biography

Robert J. Buenker Received B.S. Degree (Maxima Cum Laude) in Mathematics and Chemistry from Loras College, Dubuque, Iowa in June 1963 and He Received Ph.D. Degree in Chemistry from Princeton University, Princeton, New Jersey in June 1966. July 21 –Oct. 26, 2010 Visiting Professor, Department of Chemistry, North Carolina State University, Raleigh, USA. Jan. 1, 2011- Adjunct Professor, Department of Physics and Astronomy, University of Georgia, Athens, USA.

Nikolai Kosarev

Siberian Federal University, Institute of Non-ferrous Metals, Department of Fundamental Science Education, Krasnoyarsk, Russia

Efficiency of two-step photoionization of barium atoms through excited $^3P_1$ level

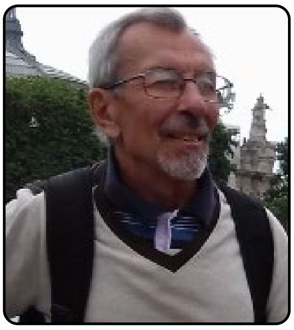
The collisional-radiative model of two-step photoionization of barium atoms through the excited 6s6p $^3P_1$ level using the pumping laser at λ_1= 791 nm and the ionizing laser at λ_2= 310 nm was constructed. The model of rate balance equations of multilevel barium atoms took into account the transfer of radiation at the atomic transition. The action of the probe laser at the wavelength λ_i= 493.41 nm was simulated to initiate resonance fluorescence. The problem has an integro-differential structure and it is solved by the method of numerical simulation in the optically dense approximation. The report demonstrates the results of modeling of the photoexcitation and photoionization kinetics of barium atoms and resonant fluorescence of barium ions. It is shown that the use of the method of quantitative spectral analysis in case of measuring the ionization yield of a barium ion beam for loading this beam into a optical trap can be considered justified. The prospects of increasing the efficiency of barium ionization in a two-step scheme using the excited 6s6p$^3P_1$ level are related mainly to an increase in power of the ionizing laser, rather than the pumping one. The results of modeling of the ionization kinetics for the optically dense medium also indicate an increase in electron temperature by more than a factor of two from superelastic electron collisions with excited barium atoms over the typical ionization time. This fact suggests that the increase in the time of three-body recombination of the ultracold plasma observed in paper [Phys. Rev. Lett. 83 4776 (1999)] can be caused by the heating of electrons in superelastic processes. The numerically obtained rate of barium ion beam loading into an optical trap is consistent with the experimental data [Opt. Exp. 19 (17), 16438 (2011)].

Audience Take Away Notes

- The collisional-radiative model of barium photoplasma creation what describes the kinetic of two-step ionization of atoms and fluorescence of barium ion. The model takes into account the radiative transfer in the lines of atom (λ= 553.5, λ = 791 nm) and ion (λ= 493.41 nm)
- The laser-induced fluorescence method makes it possible to estimate the photoionization yield of barium ions with an error of up to 8%
- Deceleration of the ultracold plasma recombination due to the heating of electrons from superelastic collisions for the characteristic times of a two-step process is predicted

Biography

Prof. Nikolai Kosarev studied Physics in Krasnoyarsk state university during 1980-1985. He received his PhD degree in 1997 at the Institute of Physics named after L.V. Kirensky, city of Krasnoyarsk, Siberian Branch of the Russian Academy of Sciences and degree of doctor of physical and mathematical sciences at the same institution in 2010. Since 2015 he is the head of the Department of Fundamental Natural Science Education of the Siberian Federal University of Institute of Non-ferrous Metals. He has published more than 80 research articles in SCI (E) journals.



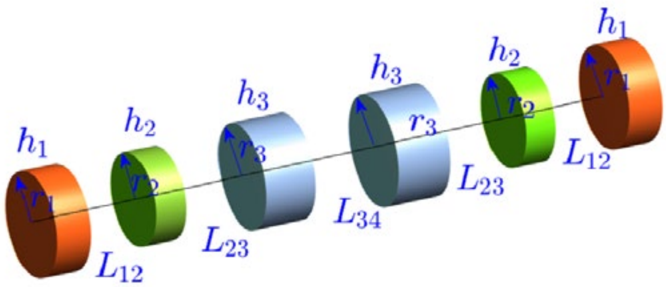
Konstantin Pichugin, Almas Sadreev*, Evgeny Bulgakov

Kirensky Institute of Physics, Federal Research Center KSC SB RAS, 660036 Krasnoyarsk, Russia

Multi scale optimization of several coaxial disks targeted on maximal q-factor

We perform optimization of Q-factor in the system of freestanding three/four/five/six coaxial subwavelength dielectric disks over all scales. Each parameter contributes almost one order of magnitude of the Q-factor due to multiple avoided crossings of resonances to give totally the unprecedented values for the Q-factors: 6.6 x104 for the three, 4.8 x106 for four, 8.5 x 107 for five and one billion for six free standing silicon disks. By multipole analysis of the resulting hybridized resonant mode we observe that such extremely large values of the Q-factor are attributed to strong redistribution of radiation that originates from almost exact destructive interference of dominating complex multipole radiation amplitudes.

The underlying idea for optimization of the Q-factor is based on the following. The system of N free standing coaxial disks offers 3N-1 scales to vary in general, N radii r_j, N heights h_j, j=1, 2, ..., N, and N-1 distances L_{12}, L_{23}, ..., $L_{N-1,N}$. Accounting that one of the scales is to be chosen for dimensionless ratios, we obtain totally 3N-2 parameters. It is reasonable to assume that symmetrical structures could radiate less compared to non-symmetrical structures. Then in frame of this assumption (3N-1)/2 free parameters are left to vary as shown in Figure on example N=6.



To boost the Q-factor we perform optimization procedure in parametric space for initial sets of parameters. Assume we reach maximal Q-factor for inner sub system of N-2 disks.

Then varying remaining scales L_{12}= $L_{N-1, N,}$ r_1=r_N, h_1=h_N of outer dimer we realize avoided crossing of resonances of inner subsystem and outer dimmer to result further enhancement of Q-factor. Finally slight detuning of parameters of inner subsystem gives rise to unprecedented results substantially exceeding examples of whispering gallery modes or quasi bound states in the continuum in periodical array of N disks.

Audience Take Away Notes

- The audience will learn the phenomenon of an avoided crossing of resonances with complex frequencies under multi scale variation of all scales in the system of N resonators. That enormously enhances the Q factor of sub wavelength dielectric resonators

- Besides fundamental interest in research engineering of extremely high Q factor by variation of parameters of two, three, etc dielectric resonators by means of avoided crossing of resonances of isolated resonator provides a practical solution to a problem ultra-high Q factor resonant systems. That paves new ways to sensing, lasing, etc Biography of presenting author

Biography

Prof. Almas Sadreev is a Russian Physicist. He received the first Doctoral degree from Kazan State University, Kazan, Russia in 1974. Then he started his teaching activity in Krasnoyarsk University, Krasnoyarsk, Russia and research activity in L.V. Kirensky Institute of Physics, Krasnoyarsk, Russia in field of theory of Condensed Matter. He received the second doctoral degree in activity in L.V. Kirensky Institute of Physics, Krasnoyarsk, Russia. From 1992 he is full professor and from 1994 he is the Head of Laboratory of theory of nonlinear processes L.V. Kirensky Institute of Physics, Krasnoyarsk, Russia. Since 1996 he works in department of theoretical physics, Universitet of Linkoping, Sweden from where he received the Honorous Causa Doctor in 2002. Currently he is the the Head of Laboratory of theory of nonlinear processes L.V. Kirensky Institute of Physics, Krasnoyarsk, Russia. Published 151 papers by ISI knowledge. His main interests are focused in Bound states in continuum in open electromagnetic, optical, acoustic systems and in micro electronic devices. Many results by Almas Sadreev in this hot topic were pioneering.

Mojtaba Ahmadieh Khanesar*, David Branson, Samanta Piano
Faculty of Engineering, University of Nottingham, Nottingham NG7 2RD, United Kingdom

Optical metrology devices for industrial robot calibration using intelligent optimization approaches

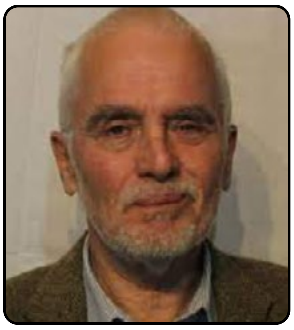
Using forward kinematics of an industrial robot, it is possible to calculate its position and orientation using joint angle readings. However, forward kinematics of industrial robots include uncertainties. One of the major sources of uncertainties in the industrial robot forward kinematics are uncertainties caused by DH parameter values of an industrial robot. Assembly and manufacturing tolerances may cause differences between actual and nominal DH parameters. We have used different intelligent optimization approaches such as gravitational search algorithms, and artificial bee colony to tune DH parameters of an industrial robot. Precision position feedback is provided using optical metrology equipment such as laser tracker, laser interferometer, and photogrammetry systems. Therefore, this talk presents a comparative study on the use of above-mentioned intelligent optimization approaches for the calibration purpose of industrial robot DH parameters. Sum of squared error approach of position is used as the cost function. Using these intelligent optimization approaches, more precise values for industrial robot parameters are estimated.

Audience Take Away Notes

- The proposed approach uses intelligent optimization approaches to deal with uncertainties within DH parameter values of industrial robots. Using these approaches, it is possible to estimate more precise industrial robot DH parameters which contributes to more precise position and orientation estimation
- Robotic engineers will use this approach to calibrate their industrial robots. Optical scientists and engineers will be given some hints to use their optical noncontact metrology equipment for industrial robot calibration purposes
- This method can be used to calibrate all industrial robots and is easily expandable within teaching and research environments. It would be an interdisciplinary research and teaching environment of metrology, robotics, and artificial intelligence
- Calibration using the proposed approach is more efficient and is beneficial for all robot design engineers, as well as robot everyday users
- The proposed algorithm is a calibration method which can contribute to the precision improvement and designing more accurate industrial robot systems by eliminating the uncertainties caused by its DH parameter values
- List all other benefits
    - o More research on artificial intelligence approaches including intelligent optimization approaches
    - o Use of advanced metrology equipment to improve position and orientation accuracies
    - o Robotics including study of forward kinematics and inverse kinematics of industrial robots

Biography

M. A. Khanesar (SMIEEE, MIET, MASME) has been working as a Postdoctoral Research Fellow with the Advanced Manufacturing Technology Research Group, University of Nottingham, U.K since 2018. He received the B.Sc., M.S., and Ph.D. degrees in control engineering from the K. N. Toosi University of Technology, Tehran, Iran, in 2005, 2007, and 2012, respectively. He has further held previous positions as a Postdoctoral Researcher with the Technical University of Denmark and an Assistant Professor with Semnan University, Iran. He held a nine-month visiting student position at the Bogazici University, Istanbul, Turkey, in 2010. He serves as an Academic Editor for Complexity journal (Hindawi/ Wiley), and an Associate Editor of Complex, and Intelligent Systems (Springer). His current research interests include metrology, manufacturing, robotics, machine learning, and control. He has published more than 40 research articles in SCI (E) journals and two books which are published with Elsevier, and Springer.



BMJC Biezanek

Distinguished Researcher, United Kingdom

Quantum-time; the arithmetic of the clocks

The CIPM has, since 1980, defined the metre by the light time of flight giving units for space of time in seconds. So, we must ask ourselves, what are the units of time itself if space is to be defined in units of time, because space and time are definitely not the same thing? The answer to this apparently great puzzle turns out to be utterly trivial. The concept of time as being a dimension of the Universe that moves forward is useful in classical mechanics but nonsense in terms of the realities observed with experiments in quantum entanglement. The answer is that history moves backwards into a dimension that we can describe mathematically as being the imaginary historic depth of the emitter in units of i-seconds. This leads to a new theory of physics explaining Quantum-Relativity (qr). I can refer to this new physics as qr-physics.

In qr-physics, we must always refer to the "apparent-wave-velocity" rather than the "speed-of-light." Light jumps in quanta from the historic emitter, into the present detector or reflector; from the quanta's notional perspective, instantly. This presents merely the illusion of waves with an apparent-wave-velocity. The apparent-wave-illusion is a reflection of rotational effects that were actually taking place, only within the historic emitting aerial body. Understanding radio ground waves requires the qr-electron-space model and that is not even covered in this starter's course material at all, only the proton is covered. Get the proton-space model (the matter-space model) right, and then all the rest is just “a walk in the park”.

Biography

The author is 73-years-old; he is happily married (but also happily separated) with four sons and eleven grandchildren. The author discovered the key solution that led to what he only now calls Quantum-Relativity (qr) at nine years of age. It was too great a burden for a nine-year-old to deal with and the author decided to leave the issue until later in his life. The author became an electrical engineer with his own company designing and manufacturing highly specialised electronic instruments for the energy industry. In 2007, the author sold his company and at the age of 57, he took up the full-time theoretical work that led, as a mere by-product of that overall work, to the development of what he now writes as a paper entitled "Quantum-Time; the Arithmetic of the Clocks", which new approach to number theory trivializes the apparently great puzzle of quantum-relativity.

Erol Sancaktar

School of Polymer Science and Polymer Engineering, The University of Akron, Akron, OH 44325, United States

Using excimer laser to manufacture stimulative and stimuli responsive membranes

248 nm KrF excimer laser can be used to manufacture temperature and pH (stimuli) responsive polymer-based membranes for controlled transport applications. This is done by a two-step approach: In the first step, well-defined/(shaped) and orderly pores are created on commercially available polymer films by ablation using excimer laser. The same laser is used subsequently for energetic grafting and polymerization of a responsive hydrogel polymer using pulsed laser polymerization (PLP) inside the pores fabricated during the first step. This is a fast process which offers flexible tuning of flux using laser operation parameters. Thus, these 'smart' membranes allow controllable solute transport. In this presentation, determination of appropriate laser parameters and grafting solution characteristics are illustrated to obtain the desired membrane performance. We first discuss fabrication of membranes with 600 nm to 25 μm pore sizes using the laser through different metal mesh templates. The size of the pores generated by excimer laser ablation for flux in the direction perpendicular to the planar surface of the polymer film, can be reduced down to the nano scale (< 100 nm) for flux in directions transverse to the film (i.e., in the film plane) by using the excimer laser in conjunction with an innovative self-assembly technique. Polymer films processed in this manner can be stacked on top of each other and can even be incorporated with responsive hydrogels by PLP within the channels created on their surfaces (preferably prior to stacking) to be used as membranes with flux in their planar direction. The films to be irradiated are manufactured using Polystyrene (PS) / polyisoprene copolymers to produce densely packed PS and silicon (carrier plate) nano-dots using a top-down/bottom-up hybrid method by employing excimer laser irradiation on Perpendicular (PS) cylinder-containing block copolymer films. The ablative procedures can be used to modify surfaces of Poly (Ethylene Terephthalate) (PET), Polyimide (PI), Poly (3-Hydroxybutyrate) (PHB), Poly (Lactic Acid) (PLA), Poly (Methyl Methacrylate) (PMMA), and Polyurethane (PU)/Poly (Dimethylsiloxane) (PDMS) films using 248 nm KrF excimer laser. Some of these membranes were used for tissue engineering based on cell–polymer film interfacial interactions of human fibroblast cells cultured on laser-modified (stimulative) membrane films revealing that laser-induced perforation of biodegradable PLA and non-biodegradable PMMA polymer films with perforation sizes of up to 43 μm can render them effective scaffold materials for tissue engineering. Experimental results show that membranes manufactured by excimer laser are excellent choices for applications where transport/transition uniformity are the prime requirements as they possess uniform pore sizes and distribution.

Biography

Professor Emeritus (University Akron – UA, Aug. 2020) Erol Sancaktar (Ph.D.; Eng. Mechanics, Virginia Tech) is Fellow of ASME, served as ASME Technical Committee Chair for Reliability Stress Analysis, Failure Prevention (1997-2008; 2013-), Associate Editor for ASME J. Mech. Design (1995-2006) and Medical Devices (2006-2013) and organized 30 Conferences. He taught at the Mechanical Eng. Dept., Clarkson University during 1978 to 1996 before joining UA in 1996 as Professor of Polymer Engineering and Professor of Mechanical Engineering (starting 2009). He edited 24 books, authored 112 journal articles and 30 book chapters. He delivered 247 technical presentations and has 4 patents.

Moumita Das

Assistant Professor, Department of Physics, Malda College, Malda, - 732101, India

Two-mode squeezed states in four wave mixing process

Non-classicality refers to a property of quantum states which has no classical analogue. Quantum squeezing is one of the examples of a non-classical state which has a wide range of applicability. Light is said to be in a squeezed state if it has a quantum uncertainty of certain pairs of observables is reduced below the limit imposed by Heisenberg uncertainty. Squeezed light is usually achieved through the reduction of amplitude fluctuations in a coherent state or vacuum state by using certain optical nonlinear interactions. In our present study, we propose a four-wave mixing process for obtaining two-mode squeezed states. Interaction of the radiation field with the third-order nonlinear optical media gives rise to the four-wave mixing process. Here totally quantum mechanical bosonic Hamiltonian is used. Heisenberg's equations of motion for various modes involving pump, signal and idler are constructed. These equations are coupled nonlinear differential equations and are not exactly solvable in closed analytical form. Hence, the Sen-Mandal perturbative technique [1-6] is used in order to solve these coupled nonlinear differential equations and the solutions obtained by this approach are more general than the well-known short-time approximation method. These solutions are exploited to study the intermodal squeezing of the four-wave mixing process. We have shown that there is a possibility of finding the squeezed states for different experimentally realizable parameters. It is reported that the four-wave mixing process is a good resource for producing intermodal squeezing.

Biography

Moumita Das is currently working as an Assistant Professor of Physics at Malda College, WB, India. She is teaching undergraduate physics for more than 10 years. She is doing research since 2015 and is about to submit her thesis soon. Das's research mainly focused on non-classical effects and its potential applications in various optical and atomic systems like Four wave mixing, Zeno, Anti-Zeno effect. She has published four research papers in different reputed journals. Also, she has presented a few research papers at National and International conferences, and seminars. She has collaborated with several researchers in India and outside of India.

Meera Ramrakhiani[1]*, S K Panday[2], Nisha Dwivedi[3]

[1]Department of Post-Graduate Studies and Research in Physics and Electronics

[2]Department of Physics, Govt. Model Science College, Jabalpur

[3]Department of Physics, St Aloysius College, Jabalpur Rani Durgavati Vishwavidyalaya, Jabalpur – 482001, India

Estimation of power output and conversion efficiency for quantum dot lasers

Interest in Quantum Dot Lasers stem mainly from the low threshold current which can result due to quantization of energy levels and change in density of state function. In the most commonly used laser separate confinement heterostructures, the nanoscale active region is “built into” the waveguide region (Optical Confinement Layer, OCL) based on a wide gap semiconductor material.

The most important characteristic of quantum dot laser is the amount of light it emits as current is injected into device. The dependence of laser power Output (P) on Current (I), cavity length and various other parameters has been estimated on the basis of rate equations model. Linear relation has been obtained between P and I and as the cavity length increases, slope of P-I characteristic decreases.

The external quantum efficiency indicates the efficiency of a laser device in converting the injected electron-hole pairs (input electric charges) to photons emitted from the device (output light). External differential quantum efficiency decreases linearly with increasing cavity length. As the internal loss increases, the slope of external differential quantum efficiency versus cavity length decreases. The internal quantum efficiency is independent of the geometrical properties of the laser device, such as the cavity length or the stripe width. Internal quantum efficiency is one of the main Figures of merit that should be used in assessing the quality of the semiconductor wafer from which the quantum dot laser is manufactured from.

One of the most important device characteristics of a laser diode is the efficiency of conversion □c of the input electric power into output optical power P. Power conversion efficiency is found to increase with increasing drive current, gets its maximum value and after that it decreases slightly with increasing drive current. Power conversion efficiency also depends on different parameters like cavity length, internal efficiency, threshold current.

Audience Take Away Notes

- This work will help to understand how various parameters affect the light output obtained from quantum dot lasers
- This will help the audience to decide which material and of what size, should be used to get laser of required power with higher efficiency
- This could be used by other faculty to expand their research or teachings by taking other parameters also into consideration which may suggest even better performance of the device
- This suggests how to reduce the threshold current for a diode laser by using quantum dots of different semiconductors

Biography

Dr. Meera Ramrakhiani has been the Professor and Head, Department of Physics and Electronics and also Dean, Faculty of Science at Rani Durgavati University Jabalpur, India. She has done her graduation, M.Sc. and Ph.D from the Rani Durgavati University and has 40 years of teaching and research experience. More than 30 students have completed their Ph.D. degree under her supervision in the field of nanomaterials, luminescence and photovoltaic solar cells. Dr. Meera Ramrakhiani has authored/co- authored 2 books, 3 monographs and about 400 research papers/book chapters/articles and edited Special issue of The Open Nanoscience Journal' and book entitled 'Recent Advances in photovoltaic'. She has been reviewer to many national/international journals and has received many awards.

Apurva Kumari Singh

Electronics and Communication Engineering, B V Raju Institute of Technology, Narsapur, Telangana, India

Implementation and comprehension of hardware based on field programmable gate arrays for real time image processing

Image processing methods and its applications are deeply rooted in current and future technologies. These methods make it possible to carry out a various operation to obtain detailed information from an image. Recently increased demand for the use of image processing algorithms to reduce the complexity of computation and work for the scenario in real time. There have been numerous advances in the area of image processing in software and hardware implementation. The system focuses more on hardware to store information efficiently. Using FPGA provides greater flexibility to manipulate image processing methods in the hardware field and complete the work scenario in real time. Edge detection techniques such as Robert, Prewitt and Sobel are used to detect objects' edges using FPGA. These techniques are important for detecting objects, obstructions and locating object boundaries. To implement algorithms, require a VHDL or Verilog hardware description language, Xilinx Vivado and MATLAB software-based platforms are used for simulation. The real-time application of these algorithms offers enormous possibilities for scientific research into the hardware domain.

Audience Take Away Notes

- Methods for image processing to reinforce the study's perspective in real time scenario
- Image transformation algorithms that are efficient and suited for hardware implementation utilising an FPGA
- Image processing techniques and various methodologies would aid researchers and academicians in broadening their studies into new areas. The real-time use of these algorithms opens up a multitude of possibilities for systematic investigation in the hardware arena. The solution will simplify the processing time and restore the image

Biography

She received the Ph.D. degree in electrical engineering from the Birla Institute of Technology and Science-Pilani, Hyderabad. She is currently working as an Associate Professor with the Department of Electronics and Communication Engineering, B. V. Raju Institute of Technology (BVRIT) Narsapur, Hyderabad. Her research interests include digital image and video processing, particularly haze and fog removal, and contrast enhancement. She has 6+ years of experience of educational and industrial Projects at national/international levels. She is a reviewer of IEEE Transactions on Circuits and Systems for Video Technology, IEEE Access, ACM Computing Surveys, IET Image Processing, and Neurocomputing.

Vladimir Koltsov

Nuclear Research Laboratory, Khlopin Radium Institute, Sankt-Petersburg, Russian Federation

On the width of γ-line and the photon structure

The reason to turn once again to the question of the natural width Γγ of the photon or γ-radiation line is provided by the discovery of an increase in the half-life $T_{1/2}$ for nuclear isomers in a metal matrix (see ref. [1, 2] and references therein). For nuclei in such a matrix, a decrease in the width Γγ can be expected, since, according to generally accepted concepts, $\Gamma\gamma \propto \hbar \ / T_{1/2}$ for the emission of photons in a transition from an excited state E* of a half-life $T_{1/2}$ to the ground state.

However, even in early Mossbauer experiments with the 57mFe isomer (E* = 14 keV, $T_{1/2}$ = 98 ns), a decrease in Γγ was observed with an increase in the age of the E* level (see, e.g., ref. [3]), which could be interpreted as a result of a decrease in the level width with its age. But such an interpretation is not allowed by the experiment [4] with the 181mTa isomer ($T_{1/2}$ = 6 μs), in which broadening of the 6.2 keV γ-line was observed due only to the shading of the absorber from the emitter by a mechanical shutter, which opened their mutual visibility for a time of 1 μs without referencing by the time the isomer was formed. Hence it follows that the width Γγ is determined not by the value of $T_{1/2}$, but only by the time Tγ, which in the Mossbaur experiments the absorber nucleus sees the emitter before the emission of an energy quantum. Of course, if there are no restrictions on the measurement time of the width Γγ, then the average value Tγ is proportional to $T_{1/2}$.

Then, taking into account that the energy of the γ-transition is emitted in less than 1 ns – this can be seen, for example, from the duration of the γ-signal in the scintillator, we can assume the following photon structure [5]. Immediately after the formation of the excited state E*, the nucleus begins to emit an electromagnetic wave of frequency ω that does not carry energy – abbreviated as a 0-wave. The duration of this 0-wave determines the width Γγ. The energy quantum $\hbar\omega$ is emitted at the end of the 0-wave. The energy $\hbar\omega$ may not be emitted at all if the state E* decays via another channel, and then the 0-wave will exist on its own, without an energy quantum. A possible source of the 0-wave is the virtual transitions from the E* level to the ground state and back before the emission of an energy quantum.

The 0-wave with a quantum $\hbar\omega$ "on its tail" resembles a pilot wave introduced by De Broglie to explain the wave-particle duality of electrons. It is interesting to study effect of 0-waves on absorber nuclei, for example, to search for the modulation of the Γγ value via an additional resonance irradiation of the absorber in Mossbaur experiments.

Audience Take Away Notes

- The proposed structure of the photon makes it possible to explain the corpuscular-wave dualism of the photon – the 0 wave is responsible for the wave properties of the photon, the singularity "on the tail" of the 0-wave in the form of an energy quantum propagates along with the 0-wave and is responsible for the photon corpuscular properties
- With such a description of the photon structure, many unresolved questions remain. In particular, the structure of the energy quantum "on the tail" of the 0-wave is unclear, and the mechanism by which the 0-waves can narrow the absorption line of γ-quanta is unclear also

- But already now we can hope that 0-waves will find their application. For example, by detecting a 0-wave, one can in principle detect an excited object and predict its future decay. It is also interesting to consider the possibility of transmitting information using 0-waves. And it is possible to build a 0-wave generator without emitting energy

Biography

Vladimir Koltsov in 1976 graduated from the Sub-faculty of nuclear physics, Faculty of physics and mechanics, St. Petersburg Polytechnic Institute, Russia. He works as a researcher at the Khlopin Radium Institute, Saint-Petersburg. On the topic of this work, he has published more than 20 articles in reputed journals.

C A Hernandez Gutierrez*, J. E. Moreno Araujo

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UV-led characterization and design strategies for water treatment

This research paper explores the design, characterization, and testing of a UV-C LED-based lamp for water disinfection. UV-C radiation is an alternative disinfection method that has advantages over chemical disinfectants, including its effectiveness against bacteria, viruses, and protozoa without changing the taste or odor of water. However, UV-C LEDs face challenges, including low external quantum efficiency, which results in higher operating currents compared to visible light LEDs. Excessive self-heating caused by high operating currents is another issue that can compromise the integrity and lifetime of the UV-C LED. The paper discusses the optical characterization of a single UV-C LED without heat dissipation, showing a dramatic drop in optical intensity at high currents. Excessive current consumption and temperature are identified as the primary causes of this reduction, which is attributed to defects in the LED's epitaxial structure. Additionally, the "thermal droop" effect, wherein emitted wavelengths shift towards longer wavelengths as LED temperature increases, is observed. To address the issue, an aluminum heat dissipation plate to stabilize the temperature of the UV-C LED was studied. Furthermore, different bias conditions such as constant current, PWM signal, and High-Current within low time were applied to the E.coli bacteria to evaluate the inactivation effectivity.

Biography

Dr. Carlos Alberto Hernández Gutiérrez is a researcher who graduated as an Electronics Engineer from the ITT in 2009. Subsequently, he studied for a Master's Degree in Solid State Electronics and a Ph.D. in Nanotechnology, both at CINVESTAV-IPN. He worked for the National Polytechnic Institute as a Professor of Electronics from 2011 to 2017. In October 2018, he joined the University of Texas at Dallas as a Research Associate working on integrated circuit design for radiation detectors. Afterward, he joined as a professor at the TecNM/ITTG (March 2020). His research areas are optoelectronics devices such as Solar cells, photodetectors, and LEDs.

Valentyn Nastasenko
Doctor of Technical Sciences, Professor of the Department of Transport Technologies and Mechanical Engineering, Kherson State Maritime Academy (Ukraine)

On the possibility of experimental determination of the mass of photons

The work relates to the basics of quantum physics and photonics, in particular to the formation of photons in two states: elementary particles and their electromagnetic radiation. The study of these problems is an urgent and important task that has not been fully resolved for their energy and mass indicators. Solving the problem of experimentally determining the mass of a photon on the basis of reliable physical laws and regularities and developing a method and device for its measurement is the main goal of the work being performed.

Work results: At present, it is generally accepted that a photon has zero mass, since its presence contradicts the principles of relativism, in which, when the speed of light is reached, an object shrinks to 0 and its mass tends to infinity.

However, the principles of relativism can be questioned, since in the work Initial Quanta Level of the Material World and Substantiation of Its Parameters, DOI: 10.9734/bpi/mono/978-81-19491-00-1, it is substantiated that Nothing in the Universe can be compressed to a size smaller than the Planck length lP = (hG/c^3)0,5 = 4.05·10-35 m, which is justified by a strict physical dependence obtained on the basis of the fundamental physical constants c, h, G.

Therefore, a contradiction arises between the principles of relativism, which have not been fully verified in the zone of velocities close to the speed of light c, and repeatedly verified physical constants c, h, G. In this case, the hypothesis of a non-zero photon mass has the right to exist, and the rest mass of the photon m = $h/(T_{c2})$, where T is the oscillation period of its waves, is the relativistic mass of the photon. However, only reliable experimental studies can serve as a criterion for its verification.

The main goal of this work is to develop a method and device for determining the mass of a photon. It is based on the experiments of Professor Lebedev on measuring the pressure of light. If a similar device with a pair of balanced measuring petals is placed horizontally, one of them is covered with a screen, and the other is irradiated with laser light from above and below to balance the pressure, then photons can accumulate on this petal. After some time they will change the equilibrium of the pair if the accumulated photons have mass.

Preliminary calculations show that the energy consumption for the creation of light by a laser, the total mass of photons is 10^{-8} kg, will be about 1 MW, and the result will be noticeable after 0.5 years of irradiation.

Conclusion: It is proposed to conduct such an experiment by everyone who has such technical and economic capabilities. A complete description of the experiment is available.

Audience Take Away Notes

- New ideas about the parameters of a photon, as about an elementary particle, which, possibly, has a mass
- For the first time, it seems possible to establish whether a photon has mass or not, in a direct way, on the basis of real experiments. After they are carried out, the final answer "has" or "does not have" can be obtained

- Under the conditions of the war in Ukraine, it is impossible to conduct this experiment, no money or technical means are allocated, they are more necessary for solving other more important problems than theoretical physics
- New ideas about the principles of relativistic change in size and mass in the Universe. Now they are considered to be infinite, but in the framework of real physics, which follows from the fundamental physical constants c, h, G, they are finite quantities
- These factors can make significant changes in the theory and practice of quantum physics, which will have a great impact on the development of further science
- Performed your research in the field of light and light radiation (including laser radiation) and build your theories based on new knowledge
- It will introduce stricter certainty and increase the reliability of the work performed on the study of light and light radiation (including laser radiation).
- They can, with a link to the original sources
- Provides, but the final possibilities depend on the problem being solved
- It will increase, but the final possibilities depend on the task being solved
- List all other benefits
    - Significant changes in scientific ideas about the material world are possible at all its levels - from the physical part to the Universe as a whole
    - Since it is impossible to conduct an experiment in Ukraine, everyone who wants to conduct it, which has the financial and technical capabilities, is invited

Biography

Valentyn Nastasenko, Kherson State Maritime Academy Ukraine, faculties of ships power engineering, the department of transport technologies and mechanical engineering. Dr. of technical sciences, Professor. A sphere of scientific interests includes quantum physics, the theory of gravitation, fundamentals of the material world and the birth of the Universe, the author of more than 100 scientific works in these spheres.

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The quantification of quantum dissonance in an open bipartite system

We study the dynamics of Wigner function negativity, quantum discord, entanglement and quantum dissonance for bipartite Bell-diagonal states independently interacting with dephasing reservoirs. We analyze comparatively their behavior under the decoherence effect. Our main goal is to test the ability of Wigner function negativity to measure all kinds of quantum correlations in such system. Particularly, we find that this negativity can only capture entanglement and discord. Of course it succeeded in predicting the behavior of quantum dissonance, but nevertheless, it failed to detect its presence. As a matter of fact, we conclude that Wigner function negativity cannot be used as measure of quantum dissonance in the two qubit open system.

Keywords: Wigner Function Negativity, Quantum Dissonance, Bell-Diagonal States, Quantum Discord, Entanglement, Decoherence Effect.

Biography

She is from Mohamed V university, Morocco.

Frederick H Silver

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Photonics and vibrational analysis together make a new tool to noninvasively study the mechanical properties of soft tissues

Tissue stiffness is recognized as an important predictor of tissue homeostasis and the onset of disease. As tissues age, they become stiffer and lose their flexibility leading to diseases such as osteoarthritis and peripheral vascular diseases. Some workers believe that increased tissue stiffness causes upregulation of mechanotransduction leading to increased risk of cancer and resistance to chemotherapeutic drugs. Therefore, it is very important to be able to accurately measure tissue stiffness in terms of an elastic modulus to follow changes in tissue properties that are coincidental with altered tissue structure and function. We have developed a new technique that uses audible sound and infrared light to measure the resonant frequency of tissue components based on determination of the frequency at which the maximum component tissue displacement occurs. Since soft tissues are highly viscoelastic the resonant frequency needs to be measured from the displacement in-phase with the acoustic force. The result of Vibrational Optical Coherence Tomography measurements (VOCT) is a series of vibrational peaks that represent cellular, collagenous, blood vessels and other components of the tissues. Each component of the tissue has a characteristic resonant frequency that can be converted into a tissue elastic modulus using an empirical equation found by comparing VOCT results to calibration results from tensile stress-strain curves.

Results of VOCT studies on human skin, skin cancers, ocular tissues, muscles, nerves, tendons, and fibrotic tissues indicate that cells, collagen fibers, blood vessels, and other tissue components have resonant frequencies and moduli that are similar in different tissues. The moduli of these tissue components are also similar from person to person while the distribution of these components may vary in health and disease. Increased tissue stiffness is associated with fibrosis that is associated with skin cancers and changes observed in tissue components in the corneal disease of keratoconus. Fibrosis associated with skin cancers can be differentiated from fibrosis associated with tissue changes associate with inflammation. Fibrosis affects the tissue's ability to store, transmit and dissipate elastic energy. In addition to measurements of the elastic modulus, VOCT can be used to estimate the loss modulus due to tissue viscosity. Soft tissues contain 50% or more of water leading to changes in tissue volume that occur during mechanical loading. The rearrangement of fluid during articular cartilage loading plays an important role in energy dissipation in the joint space and for this reason energy storage, transmission, and dissipation are important concepts that need to be considered to evaluate the health of any tissue. In vessel wall and ocular tissues, applied energy is stored, transmitted, and dissipated away from the site of direct loading which protects these tissues from premature mechanical failure. Tissue stiffening that occurs with age decreases the ability of these soft tissues to store, transmit, or dissipate energy leading to premature mechanical energy.

Audience Take Away Notes

- What is VOCT and how is it useful?
- How does tissue stiffness affect the disease process and resistance to treatments?
- What are the resonant frequencies and moduli of normal tissue components?

- How do the resonant frequencies and moduli of tissue components change during disease?
- Why is soft tissue viscoelasticity such an important property of tissues?

Biography

Dr. Frederick H. Silver is a Professor of Pathology and Laboratory Medicine at Robert Wood Johnson Medical School, Rutgers, the State University of New Jersey. He did his Ph.D. in Polymer Science and Engineering at M.I.T. with Dr. Ioannis Yannas, the inventor of the Integra artificial skin, followed by a postdoctoral fellowship in Developmental Medicine at Mass General Hospital in Boston, MA with Dr. Robert L. Trelstad, a connective tissue pathologist. Dr. Silver has studied collagen and tissue mechanics for over 40 years and developed the new technique termed vibrational optical coherence tomography (VOCT). US and European patents have been granted on VOCT to Rutgers on vibrational evaluation of materials and tissues.

Mayur Kumar Chhipa
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Photonic devices for photonic integrated circuits

Integration of high-speed light devices, as well as technological advances, are critical factors influencing the development of integrated photonic circuits for optical communication networks. Every day, the increasing demand for wider bandwidth needs signal processing systems at high-speed. In conventional electronics, the signal processing speed is limited due to slow speed and huge power consumption. All-optical signal processing is an alternate way to increase signal processing speed at very low power consumption. Using the new generation of optical devices to perform all-optical logic operations with rapid transfer, storage, high processing speed, and high data rate, there are advantages to the realization of photonic integrated technology in comparison to the issues discussed in conventional electronic devices. Massive research is being conducted to design miniaturised photonic components for integrated circuits.

In general, Photonic Integrated Circuits (PICs), are the combination of various photonics technologies like Photonic Crystals (PCs), Plasmonic, Planar Lightwave Circuits (PLCs) and Micro-Optical-Mechanical Systems (MOEMS). In comparison to the above discussed different platforms for PICs, photonic crystals-based devices are preferred because of their various advantages like ultra-compact in size, more temperature resilient, flexible design structure, low radiation losses, high operation speed, and very low group velocity.

The Photonic Crystal (PC) structure is micro- or nanoscale in size with two kinds of dielectrics, made up to modulate the flow of light in a designed structure on a single substrate. Moreover, among various properties of PCs, Photonic Bandgap (PBG) due to a periodic structure has attracted attention, which is one of the key components for the implementation of PICs in controlling and guiding the flow of light.

Various photonic crystals based optical devices like: Channel Drop Filter, De-Multiplexer, Optical Switch, Optical Logic-Gates, Optical Encoder etc, will be discussed during the workshop and it has been observed that, further analysis could be done for different operating wavelengths and other parameters such as modifying the radius of rods, scatter rod radius or lattice constant. Such a device structure with low power consumption, small size and high data rate, which occupy less space could be utilized in future as photonic integrated circuits for high-speed optical communication.

Biography

Mayur Kumar Chhipa is serving as Lecturer and Coordinator at the department of Electronics and Communication Engineering (ECE), Faculty of Information and Communication Technology (FICT), ISBAT University, Kampala, Uganda, East Africa. He is an active Member of IEEE and IEEE Photonic Society, IES and CASS Society. He is Counsellor at IEEE ISBAT University Student Branch, IEEE Uganda Section, Region 8. Recently, he was nominated and selected for THE PHOTONICS 100, people list by Electro Optics. He received his B. Tech and M.Tech degrees from Rajasthan Technical University in 2011 and 2015, respectively. He has submitted his PhD Thesis on Photonics. He is the author or co-author of more than 25 research papers in referred SCI/SCOPUS journals and conference proceedings. He has attended about 25 International and National conferences around the world. He has attended around 20 workshops and organized 15 workshops. His current research interests are in the areas of Optical Communication, Photonic Crystals, Photonic Integrated Circuits, Photonic Band Gap Structures, Optical Devices, and Optical Communication Networks.

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"We wish to meet you again at our upcoming events next year..."

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