2ND International Conference on

Optics and Laser technology

22, 2025
OCTOBER

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Table of Contents

Our Keynote Speakers

Jens Bliedtner
Ernst-Abbe-University
of Applied Sciences Jena
Germany

Koichi Shimizu
Waseda University
Japan

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

Katerina Lazarova
Institute of Optical Ma-
terials and Technologies
Bulgaria

Paulo Cesar De Morais
Catholic University
of Brasilia
Brazil

Jyoti Rajput
School of Chemical
Engineering and
Physical Sciences
India

Osman Adiguzel
Firat University
Turkey

Rahul Hajare
Sandip University
India

Orlando Elguera
National University of
Engineering
Peru

Thank You All

Keynote Presentations

October 22, 2025

Jens Bliedtner

Ernst-Abbe-University of Applied Sciences
Germany

Laser Polishing of Optical Glass: Enhancing Surface Quality and Efficiency for Advanced Optics Manufacturing

Abstract:

Laser polishing has developed into an innovative technique for finishing optical glass surfaces and offers a non-contact, high-precision alternative to conventional mechanical polishing processes. In this thermal process, the energy of a laser, often a CO_2 laser, is used to melt the glass surface locally and smooth out irregularities due to surface tension. Recent advances in laser parameters and beam shaping enable the processing of complex geometries, such as free-form surfaces, which present a challenge for mechanical processes. Research results show that surface roughness in the nanometer range can be achieved and at the same time processing time can be reduced compared to conventional methods. Key applications include the manufacture of optical components in 2D, 2.5D and freeform, making the process particularly relevant for high-performance optics in scientific instrumentation, medical devices and photonics. This paper examines the process dynamics, material interactions and potential for integration into modern manufacturing processes and highlights the economic and technical advantages over conventional polishing processes

Biography

Jens Bliedtner studied precision engineering at the Friedrich Schiller University in Jena. He wrote his doctoral thesis in the fields of development of pulsed laser systems and special methods in macro material processing. Since 2000, Bliedtner has been a professor at the Ernst Abbe University of Applied Sciences in Jena and the head of the department production engineering and automation of production processes. Currently, he is working in the research fields of optical technology, laser material processing and additive manufacturing.

Koichi Shimizu

Waseda University
Japan

Scattering-Suppressed 3D optical imaging of internal organs using near-infrared transillumination

Abstract:

Accurate visualization of internal organ structures through optical imaging faces fundamental challenges due to the highly scattering nature of biological tissue. Near-infrared (NIR) light in the 700–1200 nm range can penetrate tissue and enable transillumination-based imaging; however, significant scattering often degrades image quality. To overcome this limitation, we propose an advanced imaging framework that combines theoretical modeling, computational deblurring, and deep learning to recover three-dimensional (3D) anatomical structures from single-shot two-dimensional (2D) transillumination data. We model light propagation in turbid media using diffusion theory to derive a depth-dependent point spread function (PSF). This PSF is used to simulate paired datasets of blurred and sharp images, which in turn serve as training data for a neural network. The proposed network performs three tasks: correcting blurring artifacts, estimating the depth of absorbing features, and reconstructing 3D internal structures from blurred 2D inputs. Both simulation studies and experimental results validate the system's ability to suppress scattering-induced degradation and recover detailed 3D representations. This technique represents a promising advancement in noninvasive imaging, with potential applications in diagnostic medicine, functional monitoring, and deep tissue analysis using safe and accessible NIR light.

Biography

Koichi Shimizu received his M.S. (1976) and Ph.D. (1979) degrees from the University of Washington, Seattle, USA. He served as a Research Associate at the University of Washington from 1974 to 1979. From 1979 to 2016, he held academic positions as Assistant Professor, Associate Professor, and Professor at Hokkaido University, Sapporo, Japan. He is currently Professor Emeritus at Hokkaido University, Invited Research Professor at Waseda University, Japan, and Professor at Xidian University, Xi'an, China. His research has focused on biomedical engineering. He served as an Associate Editor of IEEE Transactions on Information Technology in Biomedicine from 1999 to 2007. He is a Fellow of the Electromagnetics Academy and members of the editorial board of Scientific Reports (Nature Portfolio) and Advanced Imaging

Vladimir G Chigrinov

Hong Kong University of Science and Technology
Hong Kong

Photoaligned azodye nanolayers for new liquid crystal devices

Abstract:

Photoalignment and photopatterning has been proposed and studied for a long time [1]. 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 [2]. 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

Biography

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 322 journal papers, more than 677 Conference presentations, and 121 patents and patent applications including 38 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). Since 2018 until 2020 he works as Professor in the School of Physics and Optoelectronics Engineering in Foshan University, Foshan, China. 2020-2024 Vice President of Fellow of Institute of Data Science and Artificial Intelligence (IDSAI) since 2021 distinguished Fellow of Institute of Data Science and Artificial Intelligence. Since March 2022 he is A Fellow of National Academy of Technology for his contributions to Information Electrical and Electronic Research.

Katerina Lazarova

Institute of Optical Materials and Technologies
Bulgaria

Designing responsive polymer layers: Impact of chain parameters on sensor performance

Abstract:

In the context of optical applications, polymer brushes comprise elongated macromolecular side chains that are covalently anchored to the backbone at one end, with a grafting density sufficient to induce chain extension normal to the surface. This structural arrangement can significantly influence the optical properties of the interface, such as refractive index modulation, light scattering, and surface plasmon resonance. The length and graft density of the brushes can alter their properties such as vapor-swelling ability. In many applications in air, like sensing or smart materials, polymer brushes can be key component in order to achieve desired qualities of the medium. We can say that polymer brush functionalization can impart selective sensing capabilities and improved responsiveness in a wide range of gas sensor architectures. In the present study a newly developed hygrosensitive poly(vinyl alcohol) derivatives comprising grafted poly(N,N-dimethylacrylamide) side chains of varied length and graft density are used as optical sensitive media for humidity detection. Two methods were used to evaluate the changes in the copolymers deposited as thin films in range 150-200 nm when exposed to a different humidity level in atmosphere. First, in order to study the optical sensing properties of the copolymers, reflectance spectra were measured and changes in coating thickness and spectral shift were determined. Second, parallel to that the acoustic properties were examined by monitoring the changes in the mass of the copolymer coating by using the quartz crystal microbalance with dissipation monitoring (QCM-D). The quantity of adsorbed in the copolymer water (water content) was calculated from measured sorption/desorption isotherms. The properties of the copolymer films, their response to humidity, and their potential use as active materials for humidity sensing are debated.

Biography

Katerina Lazarova has been a research scientist at the Institute of Optical Materials and Technologies „Acad. J. Malinowski" for the last 12 years. In 2013 she began her doctorate in the field of photonic crystals and optical sensors based on zeolites and porous materials. In 2016 she became a chief assistant at the IOMT-BAS and from 2019 to 2021 was a postdoctoral fellow with a scholarship in the same field. Currently Dr. Lazarova is Associate professor in Laboratory "Composite and nanostructured materials" working with polymer materials for sensing applications. Author of nearly 50 articles, with awards for presentations in scientific forums and participation in numerous scientific projects in collaboration with other scientific organizations.

Paulo Cesar De Morais

Catholic University of Brasilia
Brazil

Exploring the photosensitizing properties of halogen-doped graphene quantum dots

Abstract:

Fluorine-decorated graphene quantum dots (F@GQDs) will be herein explored as a material platform for application in photodynamic therapy (PDT). GQDs have been extensively studied in biomedical areas such as bioimaging, bio-sensing and photothermal therapy due to their superior optical and physiochemical properties. Application of GQDs in PDT has been explored lately, but currently the main challenges are inadequate singlet oxygen (1O2) quantum yield (QY), poor solubility, and biocompatibility. In this talk, the synthesis of a new class of fluorine containing GQDs (F@GQDs) will be described. The as-synthesized F@GQD sample demonstrates an average particle size below 3 nm with a fluorine doping content of around 2%. The synthesized F@GQDs show improved water solubility and biocompatibility, while emitting strong green fluorescence and QY slightly above 13%. Moreover, the photodynamic activity was successfully tested in bioassays (in vitro).

Biography

Paulo Cesar De Morais (H61), PhD, was full Professor of Physics at the University of Brasilia (UnB) – Brazil up to 2013. Appointed as UnB's (Brazil) Emeritus Professor (2014); Visiting Professor at the Huazhong University of Science and Technology (HUST) – China (2012-2015); Distinguished Professor at the Anhui University (AHU) – China (2016-2019); Full Professor at the Catholic University of Brasília (CUB) – Brazil (2018); CNPq-1A Research Fellow since 2010; 2007 Master Research Prize from UnB. He held two-years (1987-1988) post-doc position with Bell Communications Research, New Jersey – USA and received his Doctoral degree in Solid State Physics (1986) from the Federal University of Minas Gerais (UFMG) – Brazil. With more than 14,000 citations and more than 250 invited international talks (35 countries), He has published more than 500 papers (Web of Science) and filed 16 patents.

Orlando Elguera

National University of Engineering
Peru

Maser-rays Based on Synchrotron Radiation-Total Reflection X-ray Fluorescence (SR-TXRF)

Abstract:

In 2012, during the experiments performed at LNLS (Brazilian Synchrotron Light Laboratory) based on SRTXRF measurements of Ormosil films containing phosphotungstates ([PW12O40]3-) was observed an image that could be interpreted as the result of the transition from the incident X-ray beam (packets of photons) to a continuous light beam (set of continuous waves). A hypothesis could be based on a summation of small local crystalline domains, resulting in a “continuous beam”. Differently of the case of LASER beam, the excitation by synchrotron radiation could generate not only excitation but also ionization of a polyatomic/poly-molecular systems (indeed considering the whole sample), instead of monoatomic system. Thus, the presence of individual MASER (Molecular Amplification by Stimulated Emission of Radiation) beam generated by SR-TXRF could be considered. A MASER produces coherent electromagnetic waves through amplification by stimulated emission (process based on that was argued by Albert Einstein (1916-1917)). In lower ranges of energies than the corresponding to X-rays of electromagnetic spectrum like the Ultraviolet region, the Phosphotungstates molecules exhibit very interesting phenomenon as the photocromism. This phenomenon occurs when the molecules mentioned above are irradiated with ultraviolet light, which brings these molecules to an excited electronic state. The reduced phosphotungstate obtained ([PW12O40]-4) exhibit a bluish color, being called heteropolyblue. This bluish color disappears in the presence of oxygen. The discoloration time depends on time irradiation of the sample, or on the composition/thickness of the film. It is also possible found photoluminescence in the Phosphotungstates, which is due to the multiples multielectronic collisions.

Biography

Orlando Elguera studied Chemical Engineering at the National University of Engineering (Lima-Peru) with Master’s studies in Chemistry Sciences at the National University of Engineering (Lima-Peru), and with Doctorate of Science with Major in Analytical and Inorganic Chemistry at the University of São Paulo (São Paulo-Brazil). He performed as Analyst of the Laboratory of samples of Geochemical Exploration and Inorganic Compounds at SGS del Perú S.A.C (almost 5 years). He has experience in the following method of analysis: Atomic Absorption Spectrometry, Inductively Coupled Plasma Optical Emission- Mass Spectrometry and X-ray Fluorescence. He has published 11 research articles in journals.

Osman Adiguzel

Firat University
Turkey

Shape Memory Phenomena and Diffraction Studies in Copper Based Shape Memory Alloys

Abstract:

Shape memory alloys take place in a class of advanced smart materials by exhibiting dual memory characteristics, thermoelasticity and superelasticity. Thermoelasticity is basically called shape memory effect and initiated with thermomechanical processes on cooling and deformation and performed thermally on heating and cooling, with which shape of material cycle between original and deformed shape in reversible way. This phenomenon is governed by crystallographic transformations, thermal and stress induced martensitic transformations. Thermal induced martensitic transformation occurs on cooling with cooperative movements of atoms by means of lattice invariant shears in <110 > -type directions on the {110} - type close packed planes of austenite matrix, along with lattice twinning, ordered parent phase structures turn into the twinned martensite structures, and the twinned structures turn into the detwinned structures by means of stress induced martensitic transformation, with deformation the material in the martensitic condition. Superelasticity is performed with stressing and releasing material in elasticity limit at a constant temperature in parent phase region, and shape recovery is performed simultaneously upon releasing the applied stress, by exhibiting elastic material behavior. Superelasticity is also result of stress induced martensitic transformation and ordered parent phase structures turn into detwinned martensite structure with stressing in the parent phase region. Copper based alloys exhibit this property in metastable β-phase region, which has bcc-based structures at high temperature parent phase field. Lattice invariant shear and twinning is not uniform in copper based ternary alloys and gives rise to the formation of complex layered structures. In the present contribution, x-ray and electron diffraction studies were carried out on copper based CuAlMn and CuZnAl alloys. X-ray diffraction profiles and electron diffraction patterns exhibit super lattice reflections. X-ray diffractograms taken in a long-time interval show that diffraction angles and intensities of diffraction peaks change with the aging duration at room temperature. This result refers to the rearrangement of atoms in diffusive manner. It is important that diffraction, scattering, and magnification events are result of photon-matter interaction with laser or other lights in optical level. However, these events occur as photon-matter with x-ray and electron light-matter interactions in quantum level.

Biography

Adiguzel graduated from Department of Physics, Ankara University, Turkey in 1974 and received PhD- degree from Dicle University, Diyarbakir-Turkey. He has studied at Surrey University, Guildford, UK, as a post-doctoral research scientist in 1986-1987, and studied were focused on shape memory effect in shape memory alloys. He worked as research assistant, 1975-80, at Dicle University and moved to Firat University, Elazig, Turkey in 1980. He became professor in 1996, and he has been retired on November 28, 2019, due to the age limit of 67, following academic life of 45 years. He supervised 5 PhD- theses and 3 M. Sc- theses and published over 80 papers in international and national journals; He joined over 120 conferences and symposia in international and national level as participant, invited speaker or keynote speaker with contributions of oral or poster. He served the program chair or conference chair/co-chair in some of these activities. In particular, he joined in last six years (2014 - 2019) over 60 conferences as Keynote Speaker and Conference Co-Chair organized by different companies. Also, he joined over 230 online conferences in the same way in pandemic period of 2020-2024. Dr. Adiguzel served his directorate of Graduate School of Natural and Applied Sciences, Firat University, in 1999-2004. He received a certificate awarded to him and his experimental group in recognition of significant contribution of 2 patterns to the Powder Diffraction File – Release 2000. The ICDD (International Centre for Diffraction Data) also appreciates cooperation of his group and interest in Powder Diffraction File.

Poster Presentations

October 22, 2025

Adrian Olvera Nolasco

National Autonomous University of Mexico
Mexico

Optic and structural study of new Co^{2+}-Ln^{3+} hybrid coordination compounds with luminescent properties and their possible application in LED technology.

Abstract:

Currently, lanthanide ion coordination compounds are used in lighting technology, screens, money safety marks, and light phosphor converters. They present photoluminescent properties, with fine emission bands unaffected by their chemical environment. [1-3] Lanthanide ion´s emissions can be improved by coordinating them to a chromophore that absorbs energy and transfers it to the ion, thus enhancing luminescence. This ligand acts as a sensitizer (antenna effect).[4] Previous reports indicate that Salphen derivatives and their d-block metal coordination compounds may enhance lanthanides' emissions. However, only Schiff-base coordination compounds with closed-shell d-block metals such as Zn^{2+} and Cd^{2+} have been used. [5-10] Coordination compounds containing ion metals like Cr^{3+} and Co^{2+} are dark materials due to charge transfer bands absorptions that may quench luminescence. We observed that salphen d-f (Co^{2+}-Ln^{3+}) hybrid coordination compounds display luminescence in solution or a solid dispersion. The thermal stability of the compounds above 200 °C and their photoluminescent properties could make them suitable for light phosphor conversion on LED technology.

Biography

Adrian Olvera Nolasco obtained his B. Sc. (Chemistry) in 2018 and completed the M. Sc. (Chemistry) in 2021. He is pursuing a PhD in Chemistry at the Universidad Nacional Autónoma de México.

Andrea Barz

Ernst-Abbe-University of Applied Sciences Jena
Germany

Integration of Conductive Tracks on Natural Fibers Using Ultrafast Laser Processing for Smart Textile Applications

Abstract:

The integration of conductive tracks on natural fibers using ultrafast laser processing represents a transformative approach for developing advanced smart textiles. This study investigates the application of femtosecond laser-based selective activation (LSA) on natural fibers, specifically woven cotton, to create robust, flexible, and conductive pathways. The LSA process comprises three key steps: laser activation, palladium nucleation, and electroless copper plating. By optimizing the laser parameters, including fluence, pulse spacing, and line distance, homogeneous copper tracks were achieved without compromising the mechanical properties of the fibers. Experimental results demonstrate that pre-treatment steps, such as washing, significantly improve the selectivity and quality of the metallization. Process optimizations included increased palladium concentration and extended exposure times during the plating process, resulting in enhanced adhesion and conductivity of the copper layers. Electrical conductivity measurements revealed stable performance across a range of geometries, including lines, grids, and patterns designed for sensor integration. This research highlights the potential of ultrafast laser processing for enabling natural fiber-based smart textiles suitable for diverse applications, such as health monitoring, wearable electronics, and eco-friendly protective clothing. Challenges remain in ensuring washability and long-term durability, as well as integrating microelectronics and sensors for real-time data processing. Future studies will focus on scaling the process for industrial applications and exploring additional functional layers, such as insulating or energy-harvesting materials, to broaden the scope of smart textile technology. We would like to thank the Federal Ministry of Education and Research (funding label: 03RU2U033I, abbreviation UKPino) for providing financial support.

Biography

Andrea Barz studied chemistry at the Friedrich Schiller University in Jena. She wrote her doctoral thesis in the field of glass chemistry on spectroscopic and radiographic investigations of the structure of crystalline and glassy phosphates. Since 2006, Andrea Barz has been working as a research assistant in the Production Engineering and Automation working group. Currently, she is working in the research fields of optical technology and laser material processing and material analysis.

Oral Presentations

October 22, 2025

Zhuojiang Nan

Shanghai Jiao Tong University
China

A Zero-shot Self-supervised laser speckle denoising method based on noise parameter estimation

Abstract:

A laser speckle image denoising framework based on zero sample self-supervised learning was proposed to reduce speckle noise in large-range laser triangulation systems. Firstly, a dual parameter Poisson-Gaussian mixture noise model with Poisson gain a and Gaussian standard deviation σ was constructed to characterize the noise characteristics of laser speckle. Secondly, a lightweight U-Net was designed and trained to estimate mixed noise parameters. By the generalized Anscombe transform, the nonlinear mixed noise domain was transformed into a Gaussian noise domain, and a noise distribution space suitable for self-supervised learning was established. Then, the Gaussian noise domain laser speckle image was decomposed into two sub images by down-sampling strategy, which were input into a lightweight multi-scale feature extraction network composed of a two-layer Inception structure with asymmetric convolution. This architecture learns the mapping relationship between two noisy sub images to indirectly infer the intrinsic mapping between the observed values of noise pollution and potential clean signals, without the need for pre collected clean image references. Finally, the noise domain was transformed into the original signal domain via the inverse Anscombe transform, and a clean image was obtained. The experimental results showed that this method adaptively suppresses speckle noise of different intensities while preserving image details, achieving a peak signal-to-noise ratio improvement of 3.2-5.8dB compared to traditional methods.

Biography

Zhuojiang Nan is a Research Assistant with Shanghai Jiao Tong University in the School of Automation and Intelligent Sensing. His main research interests include high precision photoelectric detection technology and new intelligent sensor. He has published more than 20 papers in reputed journals and has been authorized 8 Chinese invention patents.

Nawal Maalawy Al Malky

Albaha University
Saudi arabia

Effect of growth temperature on the properties of InAsP quantum dot lasers

Abstract:

The performance of InAsP quantum dot (QD) lasers is significantly influenced by growth temperature, impacting their optical and electrical properties. This study systematically explores the effects of growth temperatures ranging from 400°C to 650°C on key laser parameters, including emission wavelength, bandgap energy, threshold current density, and optical gain. Results indicate that increasing the temperature reduces the bandgap energy from 1.35 eV to 1.20 eV, causing a redshift in emission wavelength from 750 nm to 800 nm, at a rate of approximately 10 nm per 50°C rise. Moreover, higher growth temperatures lead to an increase in threshold current density by about 0.5% per °C due to enhanced non-radiative recombination, including carrier leakage and Auger recombination, which degrade laser efficiency. Additionally, optical gain diminishes with temperature due to inhomogeneous broadening and defect-related carrier losses. These findings provide critical insights into optimizing InAsP QD lasers for optical communications, biomedical imaging, and photonic integration. The study highlights the necessity of precise growth temperature control to improve efficiency, stability, and spectral tunability, contributing to the advancement of next-generation optoelectronic systems

Biography

Nawal Al Malky obtained a Ph.D. in Laser Physics from King Abdulaziz University. Her research focuses on advanced laser applications and quantum optics. She has published five distinguished research papers in reputable scientific journals, significantly contributing to the field. She is currently a faculty member at Al Baha University, where she plays an active role in advancing scientific research and educating future generations in physics.

Hadjaj Fatima

University of Tahri Mohammed bechar
Algeria

Comparative analysis of optical confinement in ternary and quaternary GaAs-Based quantum wells using GaAs and GaAsP Barriers

Abstract:

In this work, we investigate the optical confinement characteristics of GaAs-based quantum well (QW) structures for long-wavelength optoelectronic applications. Both ternary (Ga_2 $In_{2\ 2\ 2}$ As) and quaternary (Ga_2 $In_{2\ 2\ 2}$ NyAs1-y) quantum wells are studied, with emission wavelengths of 1216.44 nm and 1310.02 nm, respectively. Two types of barrier materials are considered: GaAs and GaAs1-zPz, while the cladding layer is fixed as Al_2 $._{2\ 2}$ Ga_2 $._{2\ 2}$ As.The optical confinement factor (Γ) is numerically analyzed as a function of emission wavelength, barrier width, and effective refractive index, for both single quantum well (SQW) and multiple quantum well (MQW) configurations. The results show that Γ decreases with increasing wavelength and barrier width, particularly in MQW structures. Structures with GaAs barriers provide stronger confinement than those with GaAsP, due to higher refractive index contrast. Additionally, although the quaternary GaInNAs wells exhibit a slightly higher intrinsic refractive index than the ternary GaInAs ones at the same Ga composition ($x = 0.2829$), the longer emission wavelength of GaInNAs (1310.02 nm) leads to a lower confinement factor. This highlights the complex interplay between material composition, refractive index, and wavelength in determining optical confinement.These findings emphasize the importance of careful structural and material design to optimize confinement in GaAs-based quantum well lasers for long-wavelength applications.

Biography

Fatima is a Senior Lecturer at Tahri Mohammed University of Béchar (Algeria) and a researcher in the Laboratory of Physics and Semiconductor Devices (LPDS). She has specialized in the field of lasers and electronics throughout her academic and research career. She obtained her Engineering degree (Ingéniorat) in Electronics in 2004, with a focus on laser systems, followed by a Magister degree in 2009 in the same field. In 2017, she earned a PhD in Electronics, with a dissertation on quantum well laser sources. In 2021, she received her Habilitation (HDR), recognizing her ability to supervise doctoral-level research in laser and optoelectronic technologies. From 2011 to 2017, Fatima served as an Assistant Lecturer at Tahri Mohammed University of Béchar. Since 2017, she has held the position of Senior Lecturer, teaching electronics and laser-related subjects to undergraduate and Master's students. She has authored numerous scientific publications in peer-reviewed journals and specialized collections in the fields of lasers and electronics. Her research continues to contribute to the advancement of ptoelectronic devices, semiconductor physics, and laser technologies.

Puja Soren

Delhi Technological University
India

Exploring the impact of Gaussian impurity potential on thermodynamic quantities in a doped quantum wire under the electromagnetic field influence

Abstract:

This study explores how impurity parameters influence the energy dispersion of electron-hole pairs in a doped quantum wire containing Gaussian impurities. The system is analysed under the effects of external electric and magnetic fields, along with Rashba spin-orbit interaction (SOI). Initially, we establish the system's Hamiltonian and determine the energy eigenvalues, which are then used to compute the partition function. Our numerical findings reveal that an applied electromagnetic field alters the energy dispersion, consequently shifting the peak positions of optical absorption coefficients and modifying the refractive index. Additionally, the results indicate that increasing both the magnetic field and impurity strength leads to higher energy eigenvalues.

Keynote Presentations

October 22, 2025

Jyoti Rajput

Lovely Professional University
India

Static Magnetic Confinement Influence on Electron Acceleration Induced by Laguerre-Gaussian Laser Pulse

Abstract:

Electron acceleration using structured laser beams provides an attractive approach for developing compact acceleration systems applicable to high-energy density physics. This work presents a theoretical analysis of electron motion driven by a Laguerre-Gaussian (LG) laser pulse under the influence of a static magnetic confinement field. The inherent orbital angular momentum and helical phase structure of LG beams generate azimuthal field components that, when interacting with the cyclotron motion induced by a uniform magnetic field, significantly modify the acceleration process. A relativistic Lorentz-force model is employed to capture the coupled dynamics, and analytical expressions are derived to estimate energy gain and trajectory variations for different laser and field conditions. Numerical simulations demonstrate that magnetic confinement strengthens longitudinal trapping, minimizes transverse spreading, and enhances overall energy transfer from the laser to electrons. The findings suggest that the synergy between LG beams and static magnetic fields can address key constraints of Gaussian-laser-driven acceleration, offering a viable route toward efficient, tunable, and compact laser-based electron acceleration systems

Biography

Jyoti Rajput is featured in world's top 2% scientist list in the field of optics, and is working as a professor in the department of physics, Lovely Professional University, Phagwara, Punjab, India. She received his/ her Ph.D. degree from National Institute of Technology, Jalandhar, India in 2019. Her research areas include Laser-induced Plasma interactions viz charged particle acceleration, THz radiation generation and harmonic generation in plasma. She has submitted research proposals in DST (SERB) and CSIR. She is also a member of different reputed organizations like Plasma Science Society of India (PSSI) and Indian Science Congress Association (ISCA). She has published around 48 SCI research publications. She has been an active reviewer in eminent international SCI journals and has been an invited speaker in various internationally reputed conferences held in Germany, UK, Italy, etc. She has edited various research books and been an organising committee member with international conferences.

Rahul Hajare

Sandip University
India

Temperature dependent refractive index sensing in nanostructure engineered fibers

Abstract:

Nanostructured optical fibers have attracted significant research interest due to their relatively simple fabrication and design flexibility. This study presents a numerical investigation into the influence of various structural and thermal parameters on the refractive index and modal properties of nanostructured fibers. Key geometric factors such as air hole diameter, spacing (pitch), and the number of holes were analyzed. Results show that increasing the air hole diameter leads to an increase in the effective refractive index, while increasing the spacing between holes results in a decrease. Conversely, the number of air holes exhibits negligible influence on the refractive index. The effect of temperature on the refractive index was also examined. A direct relationship was observed: as temperature increases, the refractive index of the guided electromagnetic pulse also increases, indicating potential for temperature-based fine tuning of refractive index in active compensation systems. The analysis was carried out using the finite element method on fibers structured with a regular hexagonal crystal lattice, considering specific geometric configurations. The results provide insights into the design of temperature-sensitive fiber optic systems and sensors.

Biography

Rahul Hazare is a distinguished scholar at the Hindu University of America, Florida, recognized for his academic excellence and dedication to research. His work reflects a strong interest in the traditional knowledge systems of ancient civilizations, particularly in the fields of mathematics, astronomy, and architecture. Guided by his mentor, Dr. Ramesh S. Paranjape- a renowned scientist and former Director of the National AIDS Research Institute Dr. Hazare continues to advance his scholarly pursuits with a commitment to academic growth and innovation.

Accepted Presentations

October
22, 2025

Ajish. U

Amrita Vishwa Vidyapeetham
India

Quantum-Enhanced Sensing: Revolutionizing Landslide Monitoring with Quantum Optics Technologies

Abstract:

Landslides continue to pose a significant risk to infrastructure and human safety globally, highlighting the critical necessity for more sensitive and dependable monitoring systems. Traditional sensing technologies, although effective to some degree, are prone to precision, noise robustness, and data security problems under extreme conditions. Advances in quantum optics offer a breakthrough solution to these challenges. This review outlines the fundamental principles of quantum optics—entanglement, quantum-enhanced metrology, and quantum communication—and their promise to transform landslide monitoring techniques. We explain how quantum sensors, by exploiting effects of squeezed light and single-photon detection, can drastically improve the sensitivity and accuracy of measurements with respect to ground deformation and micro-seismicity. Moreover, the implementation of quantum-secure communication protocols is set to enhance the integrity and confidentiality of geotechnical data networks.

Biography

Ajish U is pursuing PhD in Amrita University, Kollam, India. He is interested in doing research in landslide monitoring and detecting field by aiding with emerging technologies. He worked for more than 3 years as an Assistant professor in EEE department in various engineering colleges and is passionate in teaching field.

Malgorzata

Gdansk University of Technology
Poland

Fiber Optic Sensors for Real-Time CRP Level Monitoring

Abstract:

C-reactive protein (CRP) is a key biomarker of inflammation, with elevated levels indicating various pathological conditions, including bacterial infections and sepsis. We present an optical fiberbased sensor for real-time CRP monitoring in urine, providing a rapid, cost-effective alternative to conventional methods such as ELISA.

Presented fiber optic based sensor monitors in real-time the dynamics of CRP changes. The sensor were made with infrared source, spectrum analyzer and a standard telecommunications optical fibre with modified sensor head into a microsphere covered with additional biofunctionalized layer. Used machine learning supports the detection of extraordinary increased amounts of CRP and allows early warming of epidemic. Measurements were validated on samples with different CRP concentrations in urine.

The developed sensor demonstrates high sensitivity, rapid response (<5 minutes), and potential for integration into portable diagnostic platforms for early infection detection. Its simplicity, mobility, and real-time monitoring capabilities make it suitable for field applications.

Biography

Małgorzata Szczerska professor at Gdansk University of Technology. Since 2017, she has been an associate professor in the Department of Metrology and Optoelectronics. Her research focuses on fiber optics and biophotonics, especially at the application of low-coherence interferometry for measuring physical quantities. She has authored or co-authored over 60 articles and four patent applications, notably a new class of fiber optic sensors for measuring temperature, refractive index and hematocrit levels.

Patryk Sokołowski

Gdansk University of Technology, Poland

Biofunctionalized Fiber Optic Sensors for Viral RNA Detection

Abstract:

Rapid and accurate viral diagnostics are critical for preventing the spread of infectious diseases and responding effectively to epidemiological threats. Fiber optic sensors provide near real-time measurement capabilities, making them particularly useful for epidemic monitoring and early pathogen detection. The ability to establish sensor networks enables large-scale monitoring, which is essential for widespread diagnostic applications.

This study explores the use of fiber optic sensors based on biofunctionalized microspheres for detecting viral RNA. Through specific surface modifications, such as immobilizing nucleic acid probes, we achieved high sensitivity and selectivity in identifying target sequences. The developed method enabled the detection of viral RNA at a concentration as low as 1 pM, highlighting its potential for ultrasensitive viral diagnostics. The sensor was developed using a single-mode telecommunication optical fiber, making integration into existing fiber optic networks possible, which enhances applicability in realtime medical diagnostics and modern epidemiological monitoring systems.

Biography

Patryk Sokolowski PhD candidate at Gdansk University of Technology, specializing in fiber optic sensors. His research focuses on the development and optimization of optical measurement techniques for biological materials. He's an active member of OPTICA and SPIE, as well as a board member of a scientific student organization. He have participated in multiple national and international conferences, contributing to the field of photonics and biosensing. His work involves interdisciplinary collaboration, bridging optics, electronics and biomedical applications to advance sensor technologies.

Shengsheng Wei

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Recent progress in femtosecond laser in treatment of ophthalmic keratoconus

Abstract:

Femtosecond laser, a pulsed laser technology, has gained increasing prominence in corneal refractive surgery due to its precision, safety, and reproducibility. With its proven efficacy and widespread adoption in procedures such as corneal stromal lenticule extraction, penetrating keratoplasty, deep anterior lamellar keratoplasty, and intracorneal ring segment implantation, it offers novel therapeutic options for advanced keratoconus cases that were previously limited to conventional approaches like corneal cross-linking and transplantation. These advancements include femtosecond laser-assisted intrastromal cross-linking, stromal lenticule implantation, and combined intracorneal ring segments with cross-linking, addressing the limitations of earlier techniques that solely improved visual acuity or corneal biomechanics. However, challenges persist, including increased infection risks from intraoperative room transfers, incomplete tissue cuts due to device malfunctions, and perioperative complications linked to suboptimal parameter settings.

Biography

Shengsheng Wei, MD, PhD, is an Associate Chief Physician in Ophthalmology. His research focuses on myopia prevention, refractive error correction, corneal collagen cross-linking for keratoconus, and femtosecond laser-corneal tissue interactions. With over 40 peer-reviewed publications and contributions to 3 academic books, he specializes in advancing clinical and translational innovations in corneal refractive surgery and keratoconus management.

Wei Tao

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Structural Laser Intelligent Measurement Technology and Its Application in Special Environments

Abstract:

Structural laser measurement technology plays an important role in precision measurement, and the rapid development of artificial intelligence provides it with more application potential, especially for applications facing special environments. This report mainly focus on the measurement principles of structural lasers with different measurement dimensions of "point-line-surface", combined with cutting-edge intelligent algorithms and machine learning methods to improve the overall performance of structural laser measurement systems, and applied to various special environments. Firstly, heuristic intelligent optimization algorithms are adopted to optimize the structural parameters of the optical system so as to improving the design efficiency. An illumination distribution model for the full process of "laser emission-transmission-imaging" is established, which helps to determine the optical structural parameters corresponding to the optimal sensitivity under the condition of spatial constraints, and high uniform and stable light source modules are also designed. Secondly, in response to data dither and loss caused by temperature, dust, vibration and other variations in special environments, deep learning and semi-supervised learning algorithms are combined to denoise laser images. And the three-dimensional point cloud holes are repaired using Riemann manifolds and Bayesian estimation to improve stability in extremely complex environments. Finally, this report introduces typical application cases of structural laser intelligent measurement technology in special environments, including high-precision industrial manufacturing assembly, seawater surface roughness measurement, aerospace load attitude measurement and so on.

Biography

Wei Tao is now a professor of Shanghai Jiao Tong University. Her research fields include optical precision measurement method, development and calibration of high-precision photoelectric sensor. She has published 100 research papers, and been authorized more than 30 Chinese invention patents. She is now a member of IEEE Instrumentation and OSA. She is also a committee member of China Instrument and control Society. She has won 5 awards in her research area of laser sensors.