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2ND EDITION OF

EUROPEAN LASERS, PHOTONICS AND OPTICS TECHNOLOGIES SUMMIT

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BOOK OF ABSTRACTS

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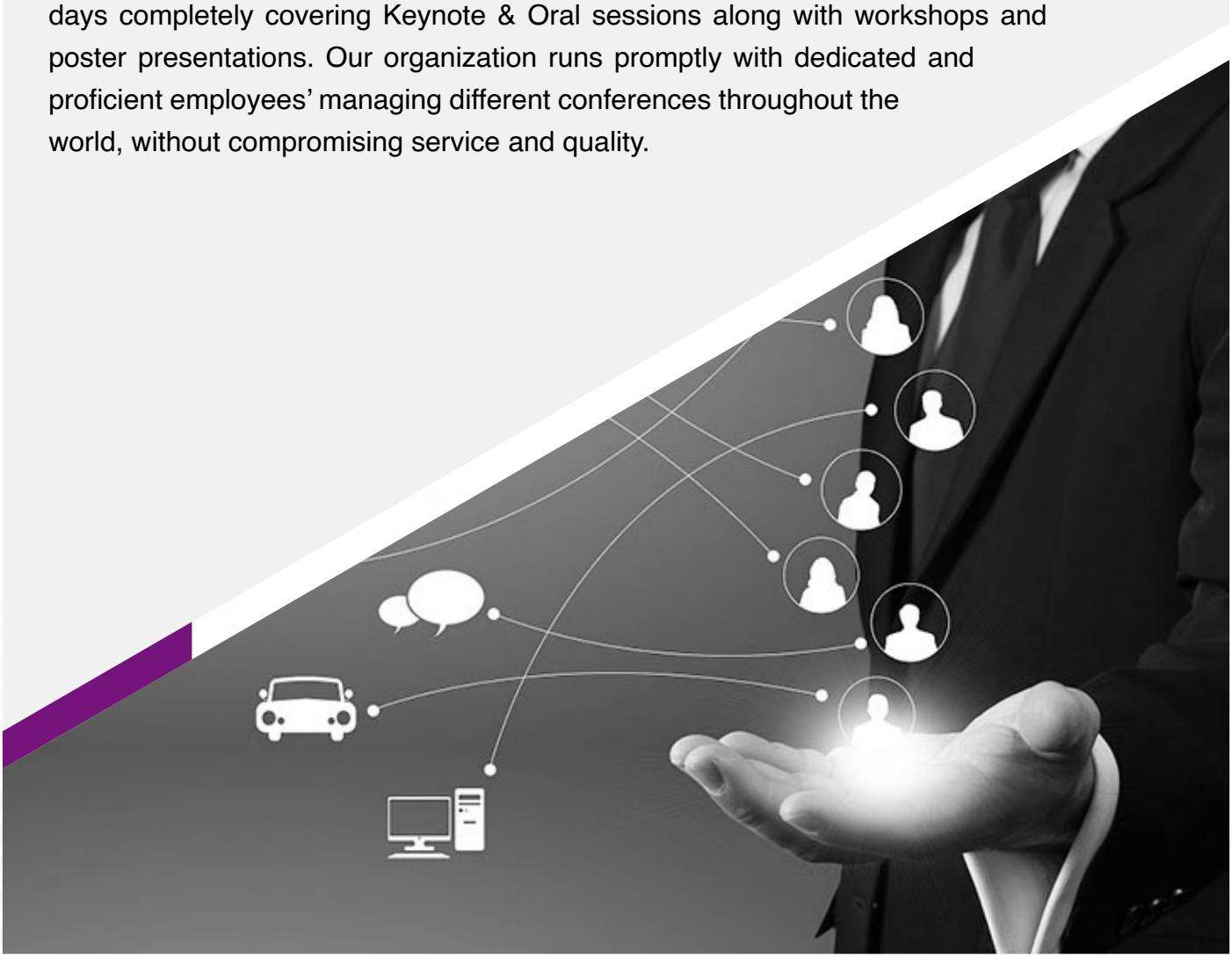
ABOUT MAGNUS GROUP

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 conference 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 2022

Magnus Group welcomes you to our Online Event entitled “2nd Edition of European Lasers, Photonics and Optics Technologies Summit” (ELOS 2022) scheduled on September 05-06, 2022. with the theme “Exceeding the Vision of Lasers, Photonics and Optics through Innovative Applications in Today’s World”

ELOS 2022 is to bring together a multi-disciplinary group of academicians and industrialists from all corners of the globe to present and share cutting-edge ideas in the fields of lasers, optics, and photonics. We aim to improve chances for social and technical engagement between these communities. It encourages top-tier research and the globalisation of high-quality research in general, making conversations and presentations more internationally competitive and focusing attention on recent remarkable discoveries in the field.

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KEYNOTE FORUM

DAY 01

2ND EDITION OF

EUROPEAN LASERS, PHOTONICS AND OPTICS TECHNOLOGIES SUMMIT

05-06 SEPT

Koichi Shimizu

School of Optoelectronic Engineering, Xidian University, China

Suppression of scattering blur in macroscopic imaging of human body using NIR light

Near-infrared (NIR) light has relatively low attenuation in human body, and reaches deeper in our body than visible light. We can visualize the internal structure of our body in transillumination imaging or oblique-illumination imaging with NIR light. However, the light is strongly scattered in body tissue which makes the quantitative spectral analysis difficult. It also makes the transillumination images seriously blurred. We have developed optical techniques to suppress the blur caused by light scattering. They are the extraction of the near-axis scattered component from the widely diffused light, and focusing the light in diffusive media using the time-reversal principle of phase-conjugate light. We have also developed new techniques to suppress the scattering blur in image processing. They are the convolution with the Point Spread Function (PSF) derived from the diffusion equation, and deblurring by the neural network trained in deep learning. In the combination of these techniques, we can effectively suppress the blur caused by the scattering in body tissue. At the same time, we can estimate the depth of absorbers in the deblurring process. The effectiveness of these methods has been verified in simulation and experiments. With these techniques, we could reconstruct macroscopic 3-dimensional internal structure of a living mouse. We also expanded these techniques for functional imaging. The blood circulation changes in mouse brain and abdomen were visualized in transillumination imaging. The distribution of oxygen saturation in a human hand could be visualized as well. The NIR transillumination with the proposed technique has been applied to the medical care of the arteriovenous fistula in dialysis treatment.

Audience Take Away:

- Audience will find the potential of a new noninvasive technique for biomedical imaging.
- They can see some techniques to solve the problem of severe blur caused by light scattering.
- They can understand the basic principle of the functional transillumination imaging.
- They will see some practical applications of the proposed techniques to animal and human bodies.
- They will see how the new deep learning techniques are used in transillumination imaging.

Biography

Professor Shimizu received M.S. (1976) and Ph.D. (1979) degrees, from University of Washington (UW), Seattle, USA. He was Research Associate of UW in 1974-79. He was Professors in Hokkaido University and Waseda University in Japan in 1979-2016 and 2016-2022, respectively. He is currently a Professor Emeritus of Hokkaido University and a Professor of Xidian University, China. He has been engaged in the studies of biomedical engineering including those of wave propagation in biological media, optical measurement, biotelemetry and biological effects of electromagnetic field. He served as an associate editor of IEEE Trans. ITB in 1999–2007. He has been a Fellow of the Electromagnetics Academy, and an editorial board member of Scientific Reports, Nature.

Gin Jose*, Paramita Pal, Artitsupa Boontan, Eric Kumi-Barimah

School of Chemical and Process Engineering, University of Leeds, United Kingdom

Functional materials engineering with femtosecond laser induced plasma

Deposition of functional materials and doping using femtosecond lasers has become an important area materials research. The Ultrafast Laser Doping (ULPD) technique is a new technique developed by us to fabricate planar waveguides on glasses and silica on silicon. In this process femtosecond lasers with pulses with different repetition rates and pulse durations were used to ablate a target material containing ions that introduce refractive index increase as well as those suitable for light amplification such as Er^{3+} and Tm^{3+}.The ablated target materials are allowed to impact on glass substrates under specific processing conditions inside a vacuum chamber leading to formation of a waveguiding layers within the subsurface of the substrate with refractive index increase as high as 10%.The rare earth doped and undoped planar waveguide layer can be fabricated on a single substrate using this method. The deposition process using femtosecond laser induced plasma on the other hand can be used for fabricating phase change materials such as VO_2.We report the successful preparation on thermochromic phase changing VO_2 from V_2O_2 using femtosecond pulsed laser deposition in the research.

Audience Take Away:

- Importance of planar optical waveguide devices and their applications.
- It will demonstrate the use of femtosecond laser in a new way to fabricate planar waveguides.
- Explore new applications of femtosecond lasers.
- Laser and amplifier engineering on silica on silicon.
- Active and passive waveguide integration on silica/glass.
- Other application areas of the laser processing technique.
- Femtosecond pulsed laser deposition of oxides.

Biography

Prof. Jose's research interests are in the areas of photonic glasses, femtosecond pulsed laser deposition and plasma implantation, planar waveguide devices on glass, silicon and polymer platforms, and photonic biosensors. The ultrafast laser plasma doping (ULPD) process that he invented has been the core technology behind novel optoelectronic applications that he is developing. He is leading a large EPSRC-UK functional materials manufacturing research project for developing ULPD for application in advanced integrated photonics for optical data communication. Glasses and seminconductors functionalised using ULPD are attractive for non-invasive biosensing, integrated photonics, anti-counterfeiting/printing in glass bottles and toughening of glass for displays.A number of researchers and industrial partners are involved in these research and development activities of his group. Another directions of research include manufacturing and application of upconversion nanoparticles, materials for passive radiative cooling and laser depsotion of oxide and chalcogenide materials. Prof. Jose received his MSc and PhD degrees in Physics from University of Calicut, India and Mahatma Gandhi University, India respectively. He was a research fellow at the Polytechnic of Milan, Italy during 2001-2002.In 2003 he joined the Department of Physics, Indian Institute of Technology Guwahati and was a Senior Lecturer/ Assistant Professor there until 2007. In 2007, he joined School of Chemical and Process Engineering, University of Leeds, UK as Senior Research Fellow and Project Manager, and since March 2013 he is the Professor and Chair in Functional Materials there.

Valentin Ivanov

Budker Institute of Nuclear Physics, Russia

Comparative analysis mathematical models for the problems of electron optics

The comparative analysis of modern mathematical models for 3D problems in electron optics is presented. These methods include both stationary and non-stationary self-consistent problems in the optics of intense beams of relativistic charged particles, as well as problems in the optics of imaging systems. Models of “current tubes” for stationary problems, “particles- in-cell” for non-stationary problems, as well as various versions of aberration theory methods for two-dimensional and three-dimensional problems of imaging optics are considered. Comparative characteristics of the effectiveness of the models under consideration are given in relation to the accuracy of the solutions obtained and the required resources of computing systems. The new approach to solve the electron optics problems in three dimensions is presented. It is based on the principal ray method suggested by G. Grinberg in 1948. That perspective approach was not realized before for full three-dimensional electron optic systems, probably because of the complexity of its mathematical apparatus. We describe the analytical technique of the boundary element method (BEM) for the field evaluation, and 3-rd order aberration expansion for the trajectory analysis. The described approaches are illustrated by solving complex problems for physical electronics devices.

Audience Take Away:

- When solving complex problems of electron optics, on the basis of the presented report, the audience will be able to choose the most appropriate and effective method that meets the goal. The report presents in sufficient detail the features of mathematical models.
- The persuasiveness of the presented material is illustrated by examples of solving complex problems of electron optics.

Biography

Dr. Ivanov studied Physics and Applied Mathematics at the Novosibirsk State University, Russia and graduated as MS in 1973. He received Ph.D degree in 1975 at the Computing Center in Novisibirsk, Prof. degree in 1991 at the. St.-Petersburg Institute of Analytical Instrumentation of Russian Academy of Sciences. Then he worked at the Institute of Nuclear Physics, Russia; Stanford Linear Accelerator Center, US; FNAL, US; ANL, US as physicist. He published more than 250 research articles and 6 monographs.

Alexander G. Ramm

Mathematics Department, Kansas State University

Wave scattering by many small particles and applications

The theory of wave scattering by many small impedance particles of arbitrary shapes is developed. The basic assumptions are: a « d « λ, where a is the characteristic size of particles, d is the smallest distance between the neighboring particles, λ is the wavelength. This theory allows one to give a recipe for creating materials with a desired refraction coefficient. One can create material with negative refraction: the group velocity in this material is directed opposite to the phase velocity. One can create a material with a desired wave focusing property. Quantum-mechanical scattering by many potentials with small supports is considered. The theory presented in this talk is developed in [1]-[9]. Practical realizations of this theory are discussed in [9]. In [9] the problem of creating material with a desired refraction coefficient is discussed in the case when the material is located inside a bounded closed connected surface on which the Dirichlet boundary condition is imposed.

Biography

Alexander G. Ramm was born in Russia, emigrated to USA in 1979 and is a US citizen. He is Professor of Mathematics with broad interests in analysis, scattering theory, inverse problems, theoretical physics, engineering, signal estimation, tomography, theoretical numerical analysis and applied mathematics. He is an author of 708 research papers, 20 research monographs and an editor of 3 books. He has lectured in many Universities throughout the world, gave more than 150 invited and plenary talks at various Conferences and had supervised 11 Ph.D students. He was Fulbright Research Professor in Israel and in Ukraine, distinguished visiting professor in Mexico and Egypt, Mercator professor, invited plenary speaker at the 7-th PACOM,he won Khwarizmi international award in 2004, and received many other honors. A.G. Ramm as solved inverse scattering problems with xed-energy scattering data, with non-over-determined scattering data and studied scattering problems with under- determined scattering data. He solved many specic inverse problems and developed new methods in this area. He solved the many-body wave scattering problem when the bodies are small particles of arbitrary shapes and used this theory to give a recipe for creating materials with a desired refraction coecient. These results attracted attention of the scientists working in nanotechnology. He gave formulas for the scattering amplitude for scalar and electro- magnetic waves by small bodies of arbitrary shapes and formulas for the polarizability tensors for such bodies. He gave a solution to the Pompeiu problem, proved the Schier's conjecture and gave rst symmetry results in harmonic analysis. He has developed the Dynamical Systems Method (DSM) for solving linear and non-linear operator equations, especially ill-posed. He developed a random elds estimation theory and studied convolution equations with hyper-singular integrals. Recently, he solved the millennium problem, the Navier-Stokes Problem (NSP) and proved a paradox in the NSP which shows the contradictory nature of the NSP and the non-existence of its solution on the interval t 2 [0;1) for the initial data v0(x) 6 0 and f(x; t) = 0.

Ephraim Suhir

Department of Mechanical and Materials Engineering, Portland State University, United States

Fiber Optics Structural Analysis (FOSA): Application of analytical ("mathematical") predictive modeling

The fundamentals of a body of knowledge that could be identified as Fiber Optics Structural Analysis (FOSA) are addressed. The emphasis is on the application of analytical ("mathematical") predictive modeling, as well as on the Probabilistic Design For Reliability (PDfR) of fiber optics structures. In the FOSA part of the presentation optical fibers subjected to thermal and/or mechanical loading (stresses) in bending, tension, compression, or to the combinations of such loadings are considered. The addressed structures include, but are not limited to, optical fibers of finite length: bare fibers; jacketed and dual-coated fibers; fibers experiencing thermal loading; fibers soldered into ferrules or adhesively bonded into capillaries. The roles of geometric and material non-linearity; dynamic response to shocks and vibrations; and possible applications of nano-materials in new generations of coating and cladding systems are addressed. The PDfR part of the presentation is concerned with a novel, fruitful and challenging direction-probabilistic modeling of the states of stress and strains and the useful lifetime of electronic,opto-electronic and photonic products and particularly optical fibers and interconnects.The rationale behind the PDfR concept is that the probability of failure is never zero, but could be predicted and made adequate for a particular product and application. It is concluded that the application of the methods and approaches of FOSA can be very helpful, in addition to the computer simulation and experimental efforts in creating a viable and reliable fiber optics product and that the PDfR approach enables designing and fabricating a viable and reliable optoelectronic product with the predicted, assured and even, when appropriate, even specified adequate probability and the useful lifetime of a photonic product.

Audience Take Away:

- Compare the results of the calculations based on the application of the addressed analytical ("mathematical") stress-strain and bow modeling with the computer simulation (such as, e.g., Finite Element Analyses (FEA)) data. These two major modeling approaches are based, as a rule, on different assumptions and employ different calculation techniques, and if the data obtained using these approaches are in agreement, tn there is a good reason to believe that these data are accurate and trustworthy.
- Use the data obtained based on the analytical modeling to create the most accurate and effective preprocessing model, when employing various FEA programs.
- Use the obtained data to plan, conduct and interpret the results of accelerated tests, including Highly Accelerated Testing (HALT) and Failure Oriented Accelerated Testing (FOAT), which is t experimental basis of the PDfR concept.

Biography

Ephraim Suhir is Life Fellow of the IEEE, the ASME, the SPIE, and the IMAPS; Fellow of the American Physical Society (APS), the Institute of Physics (IoP), UK, and the Society of Plastics Engineers (SPE); and Associate Fellow of the AIAA. He has authored about 500 publications, presented numerous keynote and invited talks worldwide, and received many professional awards. His most recent awards are 2019 IEEE EPS Field award for seminal contributions to mechanical reliability engineering and modeling of electronic and photonic packages and systems and 2019 IMAPS Lifetime Achievement award for making exceptional, visible, and sustained impact on the microelectronics packaging industry and technology.

SPEAKERS

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Feifei Gu
Shenzhen Institute of Advanced Technology,
Chinese Academy of Sciences, China

Miniature and accurate 3D structured light sensor on mobile intelligent terminal

3D vision technology has been recognized as one of the standard technologies for mobile intelligent terminals such as mobile phones to enter the new era of intelligent human-computer interaction. Now 3D vision technology has been successfully applied at mobile terminals in many fields, such as 3D live detection, virtual/augmented reality and so on. However, time-of-flight and laser speckle structured light technology are still the mainstream 3D vision technologies at mobile intelligent terminals nowadays, which were well known for their limited reconstruction accuracy. Therefore, both of them cannot be used to obtain accurate 3D information.In this case, their application scope at mobile terminals was seriously limited. To solve this problem, this work focused on the key issues of miniature structured light 3D accurate scanning method based on diffractive optical devices. By solving the key scientific problems such as high-density coding and high-precision 3D reconstruction under narrow baseline, high-precision and dynamic 3D imaging at mobile intelligent terminal can be realized. The main research contents are as follows:

1) one dimensional coding theory and method with small window and high capacity space based on epipolar constraint;

2) high precision detection and sub-pixel positioning method of the coding feature points;

3) high robust decoding algorithm of epipolar-coded pattern;

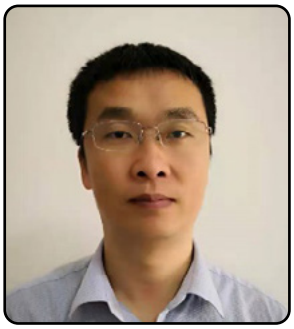
4) accurate 3D reconstruction method under narrow baseline condition. Based on the above researches, the imaging accuracy of 3D vision sensor at mobile terminals can be improved, and its application can be extended to 3D face accurate recognition,3D vision guidance and other fields. In this sense, this research has important research value and application potential.

Audience Take Away:

- People can know the current research progresses in 3D vision from my speech. Moreover, there may have potential 3D vision techniques that can be adopted in their researches.
- In this work, a new 1D coding strategy based on epipolar homography was proposed, which may be applied in other field of pattern codification.
- Miniature 3D structured light sensor was made by using diffractive optical devices, that may inspire other researchers to make their own 3D sensors.

Biography

Dr. Feifei Gu received a Ph.D. in Instrument Science and Technology from Xian Jiao Tong University in 2017.She is currently an associate research fellow at Shenzhen Institute of Advanced Technology (SIAT), Chinese Academy of Sciences (CAS).Her research interests include stereo vision-based 3D sensing and image processing. She has been the PI of over fifteen research grants including the Natural Science Foundation of China (NSFC), the Natural Science Foundation of Guangdong Province and so on. She has published more than 50 research papers, and has applied for over 16 patents until end of 2021.



Yutao Feng[1]*, Di Fu[1,2], Chenguang Chang[1,2], Juan Li, Zhinan Zhang[1,2], Yafei Zhang[1,2], Jian Sun[1,2], Peng Yan[1]

[1]Key Laboratory of Spectral Imaging Technology of Chinese Academy of Sciences, Xi'an Institute of Optics and Precision Mechanics, Chinese Academy of Sciences, China

[2]University of Chinese Academy of Sciences, China

Doppler asymmetric spatial heterodyne spectroscopy for the middle atmosphere wind measurement

A space-borne near Infrared Doppler Asymmetric Heterodyne Spectroscopy(nIR-DASH) remote sensing technique for the middle atmosphere wind field measurement is reported. The research progress of passive optical remote sensing technology for wind field in middle and upper atmosphere and the principle and characteristics of DASH are introduced. For measuring the wind field in middle atmosphere, the emission spectrum in the (0-1) vibration band of O_2 molecular transition $b^1\Sigma_g^+ \rightarrow X^3\Sigma_g^-$ is taken as the observation target source, and the system parameters of the nIR- DASH are analyzed according to the spectral radiation characteristics of the target source. The test to the prototype by laboratory calibration light source and Doppler simulation source indicate that the prototype is with 0.3 cm^{-1} spectral resolution, better than 2m/s velocity inversion accuracy RMS. For stability indicators, the phase temperature drift coefficient of the interferometer after thermal compensation is XXrad/℃, and the long-term phase stability of the interferometer system is better than 10mrad. This technique is provided with good application prospect in the field of wind measurement of the earth middle atmosphere.

Audience Take Away

- This report provides a means to measure the wind field in the middle atmosphere which can be referenced by the audience in the field of atmospheric detection. In addition, the principles of space heterodyne spectroscopy can also be applied to other fine spectral application field.
- The near infrared Doppler heterodyne spectroscopy is a double beam isopachous interferometry, which can provide a technical reference for interferometry and Fourier transform spectroscopy.At the same time, spatial heterodyne spectroscopy is also a new interference technique, which can be used for reference in physical optics teaching. The content of the report also has reference value to designers in the field of atmospheric measurement and fine spectral measurement. It provides a space-borne remote sensing method with higher accuracy and reliability for wind field measurement in middle atmosphere.

Biography

Prof. Yutao Feng studied Physics at the Northeast Normal University, and graduated as Bachelor in 2004. He then joined the research group of Prof. Xiang at the State Key Laboratory of Applied Optics, Changchun Institute of Optics, Fine Mechanics and Physics of Chinese Academy of Sciences, and received PhD degree in 2009 at the same institution.Then he joined the Key Laboratory of Spectral Imaging Technology, Xi'an Institute of Optics and Precision Mechanics,CAS. He has published more than 50 research articles in SCI (E) journals.

Xiaogang Ruan
Faculty of Information Technology, Beijing University of Technology, China

Observation and relativity: The speed of light is not truly invariant

In 1905, inspired by the Michelson-Morley experiment, Einstein proposed the hypothesis of the Invariance Of Light Speed (ILS), from which he theoretically deduced the Lorentz transformation, established the theory of Special Relativity (SR), and revealed the relativistic phenomena of space time and matter motion. However, to this day we still do not know exactly what role light plays in Einstein's theory of relativity, do not fully understand why the speed of light is invariant in the Michelson-Morley experiment, and do not truly comprehend why space time and matter motion exhibit relativistic phenomena. Based on the axiom system consisting of the definition of time, the conditions of wave-particle duality, and the principle of physical observability, we deduce the General Lorentz Transformation (GLT) with the same form as that of the Lorentz transformation, prove the theorem of the Invariance Of Information-Wave Speed (IIWS), and at last establish the whole theoretical system of Observational Relativity (OR). In the GLT, the position originally belonging to the light speed c is now occupied by the information-wave speed η. In particular, the GLT has generalized and unified the Galilean transformation and the Lorentz transformation: as $\eta \to c$, the GLT exactly converges to the Lorentz transformation; while as $\eta \to \infty$, the GLT exactly converges to the Galilean transformation. So, the GLT is logically consistent not only with the Lorentz transformation but also with the Galilean transformation. The theorem of IIWS suggests that the Michelson-Morley experiment does not truly support the ILS but demonstrates a significant phenomenon in physical observation: the speeds at which observation media transmit the information of observed objects exhibit observational invariance relative to inertial observers. The ILS is only a special case of the IIWS, and is only valid if light acts as the observation medium. In the Michelson-Morley experiment, the observation medium is light, so the speed of light relative to Michelson and Morley appears invariant. In fact, the speed of light is not truly invariant. The theory of OR discovers that: all relativistic effects, including the invariance of light speed and the so-called space time bending, are observational effects and apparent phenomena, rather than the objective and real natural phenomena. According to the theory of OR, Einstein's relativity and Newton's classical mechanics are just two partial theories of OR: Einstein's relativity is the theory of the optical observation in which light acts as the observation medium, and the information-wave speed is naturally the speed of light; while Newton's classical mechanics is the theory of the idealized observation in which the speed of information-wave is idealized as infinite, so it takes no time for observed information to cross space. Now, the theory of OR has generalized and unified Einstein's SR and the Galilean-Newtonian inertial theory: as $\eta \to c$, the relations of OR exactly converges to that of Einstein's SR; while as $\eta \to \infty$, the relations of OR exactly converges to the Galilean-Newtonian laws. So, the theory of OR is logically consistent not only with Einstein's SR but also with the Galilean-Newtonian inertial theory. Obviously, this corroborates the logical self-consistency and the theoretical validity of theory of OR. The theory of OR has significant implication. As Hawking remarked: "If we discover a complete theory, it would be the ultimate triumph of human reason – for then we should know the mind of God."

Audience Take Away:

- The attendees of ELOS-2022 will be mostly physicists in the field of optics or photonics. However, they do not truly understand why the speed of light is invariant and why photons have no rest mass. The theory of OR will help them understand that the speed of light is not really invariant and the rest mass of a photon is not really zero.
- According to the theory of OR, the invariance of light speed is just a sort of observational effects or apparent phenomenon, and holds only if light acts as the observation medium. So, the speed of light is not really invariant. Or in other words, the speed of light is not really insurmountable. The theory of OR will inspire physicists to explore the superluminal forms of matter motion.
- According to the mass-velocity relation in Einstein's special relativity, any object moving at the speed of light has no rest mass. So, Einstein thought that photons have no rest mass. Now, the theory of OR tells us that any object has

the rest mass of its own, and moreover, only the rest mass is the real mass. The mass-velocity relation of OR theory suggests that the rest mass of a photon can be observed or detected by means of superluminal observation media. The theory of OR will inspire physicists to explore the rest mass of a photon or a particle travelling at the speed of light.

- The theory of OR discovers that all relativistic phenomena, including the invariance of light speed, time dilation and length contraction, the relativity of simultaneity, the rest-mass problem of photons, and spacetime bending, are observational effects, rather than the objective and really natural phenomena. The theory of OR reveals the root and essence of relativistic phenomena: the essence is a sort of observational effects or apparent phenomena; the root is the observational locality, that is, the speeds of information waves or observational media are limited. The theory of OR signifies that physicist have to reexamine the Galilean-Newtonian theory of classical mechanics, to reexamine Einstein's theory of relativity, and to reshape human view of nature.
- Physicists, especially young ones, might make new discoveries if they introduce the theory of OR into the research work of their own.

Biography

Professor Xiaogang Ruan studied Cybernetics at Harbin Institute of Shipbuilding Engineering from 1978 to 1982, received Master Degreed in 1989 at Zhejiang University, and PhD in 1992 at Zhejiang University. From 1992 to 1994, he worked as a post-doctoral fellow at Nanjing University of Aeronautics and Astronautics. Then, he has been working at Beijing University of Technology. He has established the theory of observational relativity consisting of two parts: the inertial part has generalized and unified Einstein's special relativity and the Galilean-Newtonian inertial laws; the gravitational part has generalized and unified Einstein's general relativity and Newton's theory of universal gravitation.

M. Djamal*, A. Amani, N.S. Aminah

Physics Department, Institut Teknologi Bandung, Bandung, West Java, Indonesia

Fabrication and performance of sputtered blu-ray disks as sers substrates for TNT detection

Latest developments in leading fabrication methods have allowed the fabrication of Surface Enhanced Raman Spectroscopy (SERS) substrates with repeatable nanostructures on its surface that come out with reproducible analyses. Here, we fabricated a simple and reproducible sputtered Blu-ray disc surface as a SERS substrate. Unique patterned surface features and composition polymeric substrates of its surface following simple sputtering make Blu-ray disc an ideal SERS substrate. We tested the performance of this SERS substrate to detect TNT (Trinitrotoluene) at concentration of 10^{-1} M, 10^{-2} M, and 10^{-3} M. We conclude that gold-sputtered Blu-ray discs offer an excellent alternative as a SERS substrates prepared by simple, fast, and in-expensive procedures.

Audience Take Away:

- Audience will be able to learn fabrication technique of sputtered Blu-ray discs.
- We hope that sputtered Blu-ray discs offer an excellent alternative as a SERS substrates prepared by simple, fast, and in-expensive procedures.

Biography

Prof. Djamal studied Physics at the Institut Teknologi Bandung, Indonesia and graduated as BS in 1984.He received PhD degree in 1992 at Institute of Measurement and Automation Engineering, Faculty of Electrical Engineering, Universitaet der Bundeswehr Muenchen, Munich, Germany. His research interest is about sensors and sensor system, especially optical sensors. He obtained the position as a Lecturer at the Institut Teknologi Bandung since 1986. He has published more than 283 research articles.

Moumita Das*[1], Biswajit Sen[2,3]

[1]Department of Physics, Malda College, India
[2]Department of Physics, Vidyasagar Teachers' Training College, India
[3]INSA International Visiting Scientist 2018, Czech Academy of Science, Czech Republic; Former Visiting Scientist, University Malaya, Malaysia; Former Visiting Scientist, Palacky University Czech Academy of Science, Czech Republic

Study of lower order entanglement in non-degenerate four wave mixing process

Four Wave Mixing (FWM) process has shown promise in quantum optics for the generation of the non- classical state. In this paper, we are considering the non-degenerate four-wave mixing process. This process gives rise due to the interaction of the radiation field with the third-order nonlinear media. In our present study, we used the fully quantum mechanical bosonic Hamiltonian to describe the non-degenerate four-wave mixing process. Heisenberg's equations of motion for various modes involving pump, signal and idler have been constructed. These equations are coupled with nonlinear differential equations and are exactly unsolvable in closed analytical form. In order to solve these coupled nonlinear differential equations, we use the perturbative technique given by Sen-Mandal and the solutions obtained using this approach are more general than the ones obtained for the same system using a well-known short-time approximation. These solutions have been used to study the intermodal entanglement of the non-degenerate four-wave mixing process using Hillery-Zubairy criteria. It is found that the non- degenerate four-wave mixing process could be a good resource for producing intermodal entanglement.

Audience Take Away:

- The audience interested in entanglement (non classical phenomena) in four-wave mixing may be benefited from my talk.
- The young researchers in this field of non classical phenomena will get ideas how to work and what are the different ways to study the non classicality.
- I will also discuss some other phenomena like Zeno, Anti Zeno effect and perturbative approaches to deal coupled non linear differential equations that might help researchers in this field.

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.

C. K. Jayasankar
Department of Physics, Sri Venkateswara University, India

International year of glass-2022 – life line of lanthanide doped glasses for photonic applications

Out of many materials, glasses are not only used initially as decorative and colored gem stones but play life line for today progress and prosperous of modern science and technology. Moreover, glass is the only material that can be fabricated bulky slabs for construction of stable and strong monuments but also can be fabricated complex miniature sizes of optical fibers which revolutionized communication technology. In the present era, there is a huge demand for good optical quality, transparent and highly homogenous systems for solid state visible lighting,w-LEDs, waveguides, optical sensors, high density optical memories based on frequency-domain, lasers, and optical amplifiers. In this connection, widely being focused on the study of optical properties of lanthanide (Ln)-doped silicate, tellurite, germanate, and phosphate glasses. Such glass materials are very potential luminescence material for advanced science and technological applications, facilitates sustainability, a green world and enriches our lives besides promoting and celebrating 2022 as United Nations International Year of Glass (IYOG-2022). Hence, our group has been actively working in the field of Ln spectroscopy and prepared variety of Ln activated glasses, glass-ceramics and nano-phosphors and characterized their excited state dynamics systematically and uniformly. The present talk focuses and highlights the importance, preparation, optimization of the concentration as well as composition by using various spectroscopic/analytical techniques and developed Ln-doped glasses for modern photonic applications, celebrating IYOG-2022.

Acknowledgments:

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Audience Take Away:

- Importance of glasses.
- Role of rare earth doped glasses.
- Development of rare earth doped glasses for photonic device applications.

Biography

Prof.Dr.C.K. Jayasankar, Ph.D., F.N.A.Sc., studied Physics at the Sri Venkateswara University, Tirupati-517 502, India and graduated as M.Sc. in 1978.He then joined the research group of Late Prof.S.V.J. Lakshman and received his Ph.D. degree in 1984 at the same University. After two years (1984-86) PDF supervised by Dr.Pierre Porcher,CNRS-Meuodon-Bellevue, France) and another two years (1986-88) PDF supervised by Prof.F.S. Richardson, Chemistry Department,University of Virginia, USA he joined as an Associate Professor in Physics at S.V.University and elevated to Professor of Physics. So far, he has published 320 research papers in SCI(E) journals.

Subir Kumar Sarkar
Jadavpur University, India

Wireless self-organizing networks and trust management system

IEEE Electron Device Society Distinguished Lecturer, Sr Member IEEE, Chartered Engineer, FIETE, LFIE, LM ISTE, LM IACS, Coordinator of IC Design and Fabrication Centre & Coordinator of Evening Course for M Tech in VLSI Design , Professor and Former Head Department of Electronics and Telecommunication Engineering, Jadavpur University, Kolkata, India

Ad hoc networks are autonomous systems which comprise a collection of mobile nodes that use wireless transmission for communication. They are self-organized, self-configured, and self-controlled infrastructure-less networks. In the last few years, Mobile Ad Hoc Networks(MANET) and Wireless Sensor Networks(WSN) have seen increased adaption in a variety of disciplines because they can be deployed with simple infrastructures and virtually no central administration. This type of network can be set up or deployed anywhere and anytime because it poses very simple infrastructure setup and no or minimal central administration. In particular, the development of MANET and WSN provides tremendous opportunities in areas including disaster recovery, defense, health care, researchers, students, and industrial environments. A self-organizing network is a network that can automatically extend, change, configure and optimize its topology, coverage, capacity, cell size, and channel allocation, based on changes in location, traffic pattern, interference, and the situation or environment. Each node in these networks acts as trans receiver and communicates via hops when some nodes are out of coverage area. Due to high mobility the topology of the networks changes dynamically, thus making routing very challenging. Only sender intends that receiver should “understand” message contents. But because of universal electronic connectivity electronic eavesdropping, viruses, hackers and electronic fraud can threaten thereby putting special importance on security. However because of proper attention on the area of network security there is significant development of practical, available applications to enforce network security. In MANETs and WSNs, nodes may exhibit various types of misbehavior. Node’s misbehavior may be categorized into two broad types: Malicious behavior intention is to attack and damage the network, Selfish behavior intention is to save power, memory and CPU cycle. A malicious node delays packet forwarding to ensure that Time-To-Live (TTL) of the packets are expired so that the packets do not reach the destination. In order to prevent various attacks, which WSNs and MANET suffers, the possible solutions can be adapted. Trust tells the degree of reliability of other node in performing actions. It can be evaluated by maintaining a record of the transactions with other nodes directly as well as indirectly.

Biography

Prof. Subir Kumar Sarkar has completed his B. Tech, M. Tech and PhD (Tech) from Institute of Radiophysics and Electronics, University of Calcutta and Post Doctoral from Virginia Commonwealth University (VCU), USA . He has worked around 10 years in industry like Oil and Natural Gas Corporation (ONGC) as Executive Engineer , 25 years in Universities (8 Years in IIEST and 17 Years in Jadavpur University) in different capacities. He was the Head of the Department of Electronics and Telecommunication Engineering, Jadavpur University during 2011-2013, coordinator of the Evening course of M. Tech in “VLSI Design and Microelectronics Technology” 2009 -2013 & 2016- till date and Co-ordinator of IC Design & Fabrication Centre Jadavpur University from 2016 to till date. He has authored 5 Engineering text books published by CRC Press USA, Artech House USA,PAN STANFOPRD USA, S.Chand & Company Pvt. Ltd., Inda . He has already guided 43 PhD scholars (8 more registered and currently working), 18 R&D projects sponsored by different Govt. of India funding agencies have been completed/ongoing, published more than 600 technical research papers in archived International/ National journals and peer reviewed conferences. His research Areas include Nanodevices and low power VLSI circuits,Computer networks(MANET & WSN), Digital Watermarking and RFID. He has visited several countries like USA, France, the United Kingdom, Switzerland, Japan , Thailand and Bangladesh as Keynote speaker, Special Guest of Honour and Invited speaker for training, presenting papers and visiting sophisticated laboratories as a part of his collaborative research activities. He is a Senior Member of IEEE, IEEE Electron Device Society Distinguished Lecturer, Life fellow of The Institution of Engineers(India) and Life fellow of Institution of Electronics and Telecommunication Engineers, Life member of ISTE and Life member of Indian Association for the Cultivation of Science (IACS). He has successfully organized two IEEE sponsored International Conferences as Convener (2004) and as General Chair (2012). He has filed one Indian Patent vide file No: 669/KOL/2013 dated 5th June, 2013.

Jyoti Rajput
Lovely Professional University, India

Hermite cosh gaussian laser-induced electron acceleration

In this research work, we have investigated the electron dynamics employing a Radially Polarized (RP) Hermite-Cosh-Gaussian (HChG) laser beam. The Hermite Cosh Gaussian laser beam. Due to the beam has a property of earlier focus of such a laser beam, which enables it is better suited to acquiring GeV order energy over short periods of time than other laser beams. The electron acceleration process is strongly influenced by two more adjustable parameters associated with this beam: decentered parameter (b) and Hermite order (s).Throughout this investigation, better trapping phenomena have been identified. The effects of changing the intensity parameter (a_0), the beam waist width (r_0^'), the decentered parameter (b), and the order of the Hermite function on electron energy gain have been investigated.

Audience Take Away:

- The concept of laser induced electron acceleration is an innovative area of research.
- The RP HChG laser pulse's cylindrical symmetry is critical for better electron entrapment.
- The laser induced electron acceleration up to high energy explores an extensive range of applications in the fields of medicine, therapy for tumors, radiation - chemistry, material- characterization, and ultrafast phenomena studies.

Biography

Jyoti Rajput received her Ph.D. degree from NIT Jalandhar, Punjab, India in 2019. She is currently an Associate professor of Physics at Lovely Professional University, Punjab, India. Her research focused areas deal with laser induced electron acceleration in vacuum and plasma (DLA, LBWA, PBWA), harmonic generation and THz radiation. She has published around 30 research articles in various international SCI journals, authored international books and presented her research work at various international conferences/ workshops. She is also a member of different renowned associations/societies e.g., PSSI, ISCA etc. She has been an active reviewer of esteemed WOS and Scopus indexed international journals.She has delivered many international invited speakers research talks at eminent conferences. At present, she is supervising around 6 PhD research scholars.

Angelos Bouchouri*[1], Muhammad Nadeem Akram[2], Xuyuan Chen[3]

[1]Department of Microsystems, PhD Candidate at University of South Eastern Norway, Vestfold

[2]Department of Microsystems, Professor at University of South Eastern Norway, Vestfold

[3]Department of Microsystems, Professor at University of South Eastern Norway, Vestfold

Metalenses: A framework for designing and fabricating metalenses

The subject of the presentation are Metalens. Metalens are flat metamaterials that replicate the optical functions of traditional lens. While traditional lens achieves focusing by refraction, metalens achieve focusing by diffraction. They are consisted of a surface that is precisely designed and fabricated. The specific pattern on the surface modulates the light by applying phase on the propagating radiation and achieves focusing by constructive interference.

The presentation will start with a quick introduction of metalens and a comparison of traditional lens and metalens, discussing their advantages and disadvantages. While traditional optics offer high quality imaging, they are heavy, bulky and expensive. On the other hand, flat metalens are light, easy to manufacture since they are compatible with already existing photolithographic techniques. For example, low cost and flat Silicon lens can replace the expensive Germanium lens. Even though Si has a higher absorption coefficient, its reduced thickness compensates for that. On the other hand, chromatic aberrations are quite dominant in flat optics. In addition, a wide operating is hard to achieve without compromising efficiency.

Then, the framework of designing and fabrication will be explained. Given a specific lens with a specific phase profile and the operating wavelength, a set of simulations of individual building blocks of the metamaterial, Meta-Atoms, must be completed to extract their effect on the propagating radiation. Finally, one needs to place the meta-atoms in the correct location on the surface and write the designing file that is readable from the photolithographic equipment, and in most cases, this is a GDSII format file. The creation of the GDSII file must be automated since it involves the placement of thousands of meta-atoms.

The presentation will close with the possible application of metalenses, ranging from sensors, imaging equipment, infrared vision and military gear. Ongoing research will be presented. Our focus of work is infrared optical systems and most of the presenting material will be related to IR imaging.

Audience Take Away:

- It will provide a full guideline on how to design and fabricate metalens. Researchers that look to start researching this topic will be benefited by greatly reducing the time needed for background research.
- It will introduce researchers to the new topic of metalens for imaging and sensors.
- Introduce the audience to possible applications for metalens. Will provide help with the designing process of metalens and its automation for the final GDSII file.
- Will provide framework for Finite-difference frequency-domain method meta-atom simulation.

Biography

PhD candidate Angelos Bouchouri studied Materials Science at the University of Patras, Greece followed by a MSc in Physics with specialization in Photonics and Lasers. He started his PhD in January of 2022 at the university of South Eastern Norway, under the supervision of Professor Muhammad Nadeem Akram and Xuyuan Chen. The subject of the PhD are Metalens. Specifically, the design and creation of high performance metalens for infrared optical systems.

H. Boubekri[1,2]*, M. Diaf[2], R. Fertas[3]

[1]Ecole Normale Superieure d'Enseignement Technologique (ENSET), Cite des freres Bousseta, Azzaba-Skikda (Algeria)
[2]Laboratory of Laser Physics, Optical Spectroscopy and Optoelectronics (LAPLASO), Badji Mokhtar Annaba University,Annaba (Algeria)
308 May 1945 University, Guelma, Alegria

Photoluminescence properties of RE ions (Tb^{3+}, Ho^{3+}, Er^{3+}, Eu^{3+}) doped CdF_2 single crystal

This paper reports the photoluminescence properties of RE ions (Tb^{3+} Ho^{3+} Er^{3+} Eu^{3+}) doped CdF_2 single crystal In recent years, Rare Earths (RE) doped host matrix have been studied extensively due to their potential applications in green technology. They have an important role in the development of optical systems, cathode ray tubes, clean energy, postings 3D, infrared radiation detection, color display, medical applications, sensors, optical data storage, Plasma Display Panels (PDP), optoelectronic devices, biological fluorescence labeling, laser technology, luminescent paints and inks for security. They have been reported in various fields due to the electronic and optical characters arising from the 4f electrons of lanthanide adding to the stability of chemical and physical properties of inorganic host matrices. Among many solid-hosts materials studied so far, MF_2 difluoride crystals (M = Alkaline earth element, Cd or Pb) with fluorite type structure are of great interest as material for photonics.This choice refers to the low phonon frequency of such materials leading to a large number of potential emitting levels by limiting the non-radiative emissions. CdF_2 crystals occupy a specific place among MF_2 crystals. They are transparent in the UV, visible and Near Infrared (NIR) electromagnetic domain. CdF_2 is used as a main constituent of many fluoride glasses, material for laser, infrared detectors and medium for optical information processing systems. The Judd-Ofelt (JO) theory has long been considered to be one of the most successful theories in estimating the magnitude of the forced electric dipole transitions of rare earth ions. The standard JO analysis is applied to the room temperature absorption intensities of RE^{3+} to determine the $\Omega_t$optical intensity parameters extremely depending on the rare earth ion and its local environment. The accurate values of these parameters are necessary to characterize the spectroscopic and laser properties of host matrix.

Biography

Hani Boubekri was born in Algeria 1977. He is Research Professor in Physics (Radiation-Matter Interaction) and Head of physics and chemistry department in Higher Normal School of Technological Education (ENSET) Skikda Since 2013. He was Research Associate at Nuclear Research Center of Algiers (CRNA) in Nuclear Techniques Division (TND) - Laser Laboratory. He is interested on the synthesis and characterization of materials doped with rare earth ions (single crystals, glasses, nanoparticles and thin layer films), including the spectroscopic study of luminescence and the coherence properties of electronic transitions at different temperatures fo application in stable lasers, phosphors, scintillators and in other applications. He has been engaged in the studies of spectroscopic properties of the single crystals types (MF2, M= Ca, Ba; Sr Cd..) doped with ions luminescent Er, Tm, Tb and Eu in collaboration with Department of Physics "Enrico Fermi", University of Pisa Italia ,Vinča Nuclear Research Institute – Serbia and the National School of Chemistry of Paris (ENSCP, CNRS - Chemistry Paris-Tech) –France.

Horacio I. Solis-Cisneros[1], Lizzete A. Zebadúa-Chavarria[2], Carlos A. Hernández-Gutierrez*[3]

[1]Engineering Sciences PhD program, Tecnologico Nacional de Mexico, Tuxtla Gutierrez, Chiapas, Mexico

[2]Master in Mechatronics Engineering program, Tecnologico Nacional de Mexico, Tuxtla Gutierrez, Chiapas, México

[3]Electrical and Electronics Engineering Department, Tecnológico Nacional de Mexico, Tuxtla Gutierrez, Chiapas, Mexico

Theoretical analysis of structural, electrical, and optical considerations for algan-based UVC-LED development

Nitrides are one important semiconductor family since the wide bandgap exhibited from the infrared to the ultraviolet spectrum. However, it is essential to mention that several issues lack an important improvement in the efficiency and optimization of material growth. Molecular Beam Epitaxy allows controlling the thickness and progress in the study of several applications of the nitride semiconductors for photodetector, solar cells, LASER, and light-emitting diodes. This work has studied the structural, optical, and electrical considerations to develop an LED structure allowing UVC-range applications. From the state-of-the-art study, the considerations for designing and simulating an AlGaN-based LED structure have been explored.

Additionally, from previously reported experimental Mg-acceptor limit in zb-GaN above $2.0x10^{19}$ cm^{-3} to set as the maximum p-type doping concentration for p-type AlGaN-layers and finite-element simulation of the entire LED structure. By DFT calculations, activation energy for p-type dopants and the maximum Al molar fraction under the direct-to-indirect cross point limit was determined according to the value of 0.75 reported in the current literature and DFT bands calculations. The activation energy reduction over 100 meV by substituting Be instead of Mg dopant by effective mass approximation modeling considering different p-type doping concentrations for zb-AlGaN. With these, a LED structure for wurtzite and zincblende approaches was performed by SILVACO simulation considering Vegard's law for the ternary values from zincblende binary parameters. From the state-of-the-art analysis, a thin low-Al-content layer has been added to reduce the impact of a high Al content in the AlGaN contact layer, improving the optical properties without a considerable lack of electrical performance.

Audience Take Away:

- Zincblende and wurtzite LED structures were simulated where zb-AlGaN exhibits feasibility to develop UVC- LED.
- The direct-to-indirect bandgap cross point was determined around 0.75 Al molar fraction by DFT calculations, which corresponds to the state-of-the-art.
- DFT simulations exhibited around 100 meV reduction in the activation energy for p-type dopants comparing Be and Mg in a zincblende approach.
- The thin AlGaN layer and Be-doping in the p-type layer reduced Rs, improving the LED structure's electrical properties.

Biography

Dr. Carlos A. Hernandez-Gutiérrez has a Ph. D. in Nanoscience and Nanotechnology. He is Electronics Engineer with an M. Sc. On Electrical Engineering, in the field of semiconductors devices. Studying transport properties in GaN/AlGaN-based High Electron Mobility Transistors, developing InGaN-based solar cells, the design, synthesis, and characterization of new structures for solar cells and photodiodes. He has worked as a professor in Unidad Profesional Interdisciplinaria en Ingeniería y Tecnologías Avanzadas del Instituto Politécnico Nacional (UPIITA- IPN). Currently, He is Professor/researcher in Tecnológico Nacional de México Campus Tuxtla Gutiérrez in postgraduate program in Engineering Sciences).

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POSTERS

DAY 01

2ND EDITION OF

EUROPEAN LASERS, PHOTONICS AND OPTICS TECHNOLOGIES SUMMIT

05-06 SEPT

Yilmaz Eren Bolukbasi*[1], Hasan Sakir Bilge[2]

[1]Gazi University Electrical and Electronics Engineering, Aselsam Inc., Ankara, Turkiye

[2]Gazi University Electrical and Electronics Engineering, Ankara, Turkiye

FPGA implementation of laser spot detection algorithm

It is aimed to effectively detect the laser spot which are frequently used in defense industry systems, even in adverse weather conditions such as fog and rain, on the FPGA by eliminating moving elements. In this study which is the subject of this article, three video frames were taken consecutively, and it was accepted that the first of them carried a laser spot and the second and third did not. In this way, moving elements such as birds, airplanes, helicopters, unmanned aerial vehicles, people or animals which have an image close to the laser spot, will be separated from the laser and more efficient results will be obtained in foggy and rainy weather conditions. In order to get better results than the method used in previous studies, three video frames taken will be run on separated flows from the two branches and these branches will be combined in the last step of the algorithm. In the first flow, the difference matrix will be created by subtracting the next video frame without laser spot from the photo frame with laser spot, and non-linear median filtering method will be applied on this matrix in order to reduce the salt and pepper noise in the image at certain dimensions. Afterwards, it is aimed to soften the image in proportion to the selected mask value by outputting low-frequency video signals with the average filter from the convolution filters. In the third stage, after a threshold value calculation is made, the pixels above this value will be kept on the flow. Operations in the first flow will be completed to these in order to preserve the laser spot. In the second flow, which will continue in parallel with the first flow, the difference matrix of two consecutive laser unspotted frames will be created and the same methods with the first flow will be applied.Unlike the first flow, the second flow will be eroded with image erosion after the threshold filtering step. After the image dilation process, which is one of the morphological image processing methods, the image will be extended. In the first flow, in order to remove the moving elements in the image known to be lasered, after this process, morphological image processing techniques will be applied again in the second flow. Then, information from the matrices from the first and second flows will be combined to determine whether there is laser spot information and in which row and column it is located.

Engerek laser target marking device is capable of making laser pulses at determined frequencies, and it is guaranteed by the system requirements that a second laser pulse cannot be obtained in the time required for taking three video frames. Morphological image processing methods applied to achieve the result will be explained and the performance of the new algorithm will be measured by comparing the simulation results of the codes written in the VHDL language with the data obtained in the MATLAB calculation tool.

Audience Take Away:

- Audience will learn alternative image processing techniques in laser spot detection applications and will be able to try different algorithms in new studies by seeing examples in the VHDL language created to implement them on hardware.
- They will have a vision to produce similar algorithms applied in real-time defense industry systems in civilian areas such as medical and transportation.
- Median filter, mean filter, threshold filter, erosion and dilation applications can be virtually seen on simulation results.

Biography

Yılmaz Eren Bölükbaşı was born in 1989 in Yozgat. He graduated from Ankara Science High School and Yeditepe University Electronics Engineering with a scholarship. He still works as a digital design engineer at ASELSAN Microelectronics, Guidance & Electro-Optics Business Sector,which is the world 48th biggest defence industry company. He is a graduate student in Gazi University Electrical and Electronics Engineering Department and a Konya Necmettin Erbakan University Faculty of Law undergraduate student.

S. Kobtsev

Division of Laser physics and Innovative technologies, Novosibirsk State University, Novosibirsk, Russia

Incoherent laser radiation

Incoherent laser radiation may be in demand among a variety applications where high directivity and brightness of radiation could be advantageously combined with the absence of speckle patterns conventional for laser radiation. Such patterns arise as a consequence of relatively high coherence of laser radiation and generally play a negative role in many applications. Interference of the incident and reflected beams produces a typical irregular (non-uniform) distribution of the optical electromagnetic field, which is an undesirable phenomenon in many applications. A great number of publications are dedicated to reduction of the speckle effects. However, all these deal specifically with minimisation of the effect and not with elimination of it altogether. The present research takes up for the first time the possibility of a new type of radiation source, in which salient features of conventional laser radiation (high directivity and brightness) may be accompanied by low coherence. Sources of such unusual radiation may be based on noise-like pulses

[1] that consist of large numbers of sub-pulses with varying amplitude and duration, chaotically positioned within the envelope of a noise-like pulse.

[2]. Almost random structure of such a pulse must result in minimal (or absence of) interference of electromagnetic field between different parts of the pulse (e.g. between its front and rear portions). Thus, minimal or no speckle pattern should be observable.

The present report considers aspects of practical implementation of an incoherent laser relying on noise-like pulses. Discussed are the most promising cavity configurations and possibilities of adjustable degree of coherence of the output radiation. Further on, the potential problems and bottle-necks of the new type of radiation source are analysed, as is its applicability in specific tasks. The likely period of time necessary for development of commercial incoherent lasers is estimated.

Audience Take Away:

- The report provides knowledge needed to develop an incoherent laser.
- Development of a radically new radiation source (low-coherence or incoherent laser) stands to disrupt significantly the application areas of laser radiation.
- Development of incoherent laser will enable solutions to long-standing problems of many applications (laser TV, material processing, etc.) related to speckle interference of laser radiation.

Biography

S. Kobtsev received the joint B.S./M.S. degree in physics (quantum optics) from Novosibirsk State University, Novosibirsk, Russia, in 1982, and the Ph.D. and D.Sc. degrees in optics in 1992 and 2010, respectively. He is currently the Head of the Division of Laser Physics and Innovative Technologies, Novosibirsk State University. His research interests include fiber and nonlinear optics, tunable laser systems, and hi-tech photonics research and development. Prof. Kobtsev is a Member of the SPIE and APS, and a Senior Member of the OSA. He was honored with the OSA's Outstanding Reviewer Recognition in 2015.

S. Kobtsev*, D. Radnatarov, V. Andryushkov

Deivision of Laser physics and Innovative technologies, Novosibirsk State University, Novosibirsk, Russia

Compact hyper-polariser of ^{129}xe

Hyper-polarised ^{129}Xe is a highly sensitive agent used with the technologies of Nuclear Magnetic Resonance (NMR) in many applications. Conventionally, in order to produce hyper-polarised amounts of this gas, large and complex high-throughput (10–1,000 l/day) plants are used, which are mostly oriented to medical applications. On the other hand, however, there exists a broad class of problems that may be solved by access to comparatively small amounts of hyper-polarised gas (several ml). The present work considers ways of making a compact inexpensive hyper-polariser relying on commercially available components. The possibilities of a simple and small-footprint device for hyper-polarisation of small doses of the gas sufficient for one or two NMR measurements are analysed. A prototype is presented of such a compact hyper-polariser of ^{129}Xe. The proposed prototype is based on the following: hyper-polarisation of ^{129}Xe is carried out by spin-exchange optical pumping; pumping radiation is provided by a 4-W laser diode with the output line width of 2 nm; hyper-polarisation of ^{129}Xe is performed in a compact (~100-mm long) high-pressure test tube (up to 6 atm) designed to last for several dozens of cycles. The present report explains the design of the proposed prototype and discusses ways of its further improvement. The experimentally achieved hyper-polarisation degree of ^{129}Xe exceeds the equilibrium level by 3–4 orders of magnitude. Among the unexpected findings is the discovered possibility of Rb vapour pumping with radiation that has a line width exceeding the Doppler contour width in Rb vapour by over an order of magnitude. This effect enables the hyper-polariser to use relatively broad-band laser radiation. This report studies this effect and provides an explanation. Also, we studied the influence of the buffer gas (in our case, nitrogen) on fluorescence quenching of the polarised alkali metal atoms.The effects are demonstrated that emerge when the buffer gas pressure deviates from the optimum. A novel design of a compact ^{129}Xe hyper-polariser is proposed that uses an optical cell fabricated from a commercially sourced test tube and an affordable diode laser pump. The measured xenon hyper-polarisation level of 1.34% is sufficient for many applications, including characterisation of various porous materials.1. Hyperpolarized Xenon-129 magnetic resonance: concepts, production, techniques and applications (new developments in NMR, volume 4) (edts: T. Meersmann, E. Brunner). Royal Society of Chemistry, 504p., 2015. ISBN‍978-1-849-73889-7.

Audience Take Away:

- This report demonstrates that technologies of hyper-polarisation of noble gas atoms may become considerably more accessible and affordable.
- In the near future, compact hyper-polarisers of ^{129}Xe may become standard devices in both scientific and practical applications.
- Broad adoption of the proposed inexpensive technology of ^{129}Xe hyper-polarisation by spin-exchange optical pumping will enable solving of many problems through NMR measurements.

Biography

S. Kobtsev received the joint B.S./M.S. degree in physics (quantum optics) from Novosibirsk State University, Novosibirsk, Russia, in 1982, and the Ph.D. and D.Sc. degrees in optics in 1992 and 2010, respectively. He is currently the Head of the Division of Laser Physics and Innovative Technologies, Novosibirsk State University. His research interests include fiber and nonlinear optics, tunable laser systems, and hi-tech photonics research and development. Prof. Kobtsev is a Member of the SPIE and APS, and a Senior Member of the OSA. He was honored with the OSA's Outstanding Reviewer Recognition in 2015.

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KEYNOTE FORUM

DAY 02

2ND EDITION OF

EUROPEAN LASERS, PHOTONICS AND OPTICS TECHNOLOGIES SUMMIT

05-06 SEPT

Vladimir V. Rumyantsev*, Stanislav A. Fedorov, Konstantin V. Gumennyk

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

Features of electromagnetic excitations propagation in a photonic crystal with microcavities containing quantum dots

Designing and utilization of novel materials for manufacturing of the sources of coherent irradiation is currently a vast interdisciplinary area, which spans various theoretical and fundamental aspects of laser physics, condensed matter physics, nanotechnology, chemistry as well information science. Physical realization of corresponding devices requires the ability to manipulate the group velocity of propagation of electromagnetic pulses, which is accomplished by the use of the so-called polaritonic crystals. The latter represent a particular type of photonic crystals featured by a strong coupling between medium quantum excitations (excitons) and optical field. The report is devoted to elucidation of the effect of point-like defects on electromagnetic excitations (polaritons) dispersion in a 1D and 2D array of microcavity (microresonator) with embedded one-level quantum dots. It is shown that the presence of vacancies in the microcavity 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 waves.

Biography

Vladimir V. Rumyantsev is Chair of the Department of Theory of Complex Systems Dynamic Properties at A.A.Galkin Donetsk Institute for Physics and Engineering.He is Professor of Theoretical Physics and Nanotechnology Department at Donetsk National University.He received PhD in Theoretical Physics (1988) and Dr. Sci. in Condensed Matter Physics (2007). Prof. Rumyantsev has authored/co-authored 4 books, 2 chapters in books and more than 330 scientific publications. He is a member of the American Physical Society as well as Mediterranean Institute of Fundamental Physics (MIFP, Italy).

Vladimir G. Chigrinov

Hong Kong University of Science and Technology, Hong Kong

Department of Theoretical Physics, Moscow Region State University, Russia

Photoalignment and photopatterning: New LC display and photonics technology

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.

Acknowledgements

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- [2] V.G. Chigrinov, Liquid Crystal Photonics, Nova Science Publishers, 2015.

Biography

Professor Vladimir G. Chigrinov 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, 25 reviews and book chapters, 320 journal papers, more than 656 Conference presentations, and 35 US patents in the field of liquid crystals since 1974.He got Excellent Research Award of HKUST School of Engineering in 2012. 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 International Engineering and Technology Institute.

Wolffram Schroer

Department Biologie-Chemie, Universitat Bremen, Germany

Apparent mean-field criticality of the liquid-liquid phase transition of ionic solutions

Liquid-liquid phase transitions of ionic solutions were a challenging subject in Statistical Physics and provoking experimental works. The fundamental aspect of this research is founded in the long-range nature of the Coulomb interactions, which were expected to challenge the universality hypothesis that liquid-gas as well as liquid-liquid phase transitions all belong to the Ising universality class. Phase diagrams and Light-scattering measurements have been reported that led to the conclusion of mean-field criticality in such systems. However, later experiments did not state those results Ising criticality was found in all cases. We review this work and discuss measurements on solutions of room temperature ionic liquids. We demonstrate the various pitfalls that may lead to erroneous conclusions. We name chemical instability, shifting the critical temperature during the measurement, multiple scattering and local heating by the laser beam. Background scattering due to dynamical processes that are slow or fast if compared to the timescale of the scattering experiment, and non-equilibrium inhomogeneities may obscure the results. Such effects become noticeable as inconsistencies, when analyzing the temperature dependency of static and dynamic light-scattering. The amplitudes of the correlation functions that are accessible when using fibre optics turns out to be an important source of information. The 3d-cross-correlation technique enables to separate multiple and single scattering contributions as do simulations of the multiple scattering. The amplitude of the auto-correlation allows distinguishing the scattering intensity caused by the critical fluctuations from the scattering resulting from faster processes.

Audience Take Away:

- General knowledge about phase transitions.
- Knowledge about pitfalls in Light scattering measurements.

Biography

Geb 1943, studied Chemistry and Physics Technical University – Berlin (1963 – 1969), PhD 1974 Iwan Stranski -Institut TU-Berlin with (Prof. E.Lippert), 1975 – 1977, Research Fellow of the Royal Society (A.D. Buckingham Cambridge, UK, 1978-2008, Professor of Physical Chemistry Universitat Bremen, 2008,Prof. em since, 1981 Philosophical Doctor (Cambridge),Visiting professor: Trinity College Dublin (1983), Universite Nancy (1986), Universität Salzburg (1995), 2008 Editor in Chief: Journal of Molecular Liquids. Research interests: physical Chemistry, Thermodynamics, Critical phenomena, Laser-light scattering, Published more than 120 research articles in SCI journals.

Walid Tawfik

National Institute of Laser Enhanced Sciences (NILES), Cairo University, Egypt

Treatment of breast cancer using laser induced photodynamic therapy and gold nanoparticles

Animal model system research has aided in the discovery of better treatments for breast cancer.There are now a plethora of models available that reflect various types and stages of disease;which one to utilise depends on the specific research question(s) to be investigated. Due to their particular near-infrared laser absorption, gold nanorods are excellent photothermal agents in the treatment of breast cancer. However, tumor laser photothermal treatment with nanorods alone is ineffective since it is not targeted. Poly(vinylpyrrolidone) (PVP) has developed a new seedless manufacturing method for gold nanorods (AuNRs).Gold NPs with a PVP surface modification decreased Endothelial Cell (EC) viability and proliferation.

Biography

Walid Tawfik, is an Egyptian Professor, in laser physics, laser spectroscopy and ultrafast lasers at the National Institute of Laser (NILES), Cairo University, Cairo, Egypt. In 1994 he joined NILES as staff member and promoted as assistant lecturer, assistant professor, associate Professor and full professor in 1996, 2000, 2008 and, 2017 respectively. He received the B.SC, Master and Ph.D degrees in physics, laser physics, and laser spectroscopy in 1992, 1996, 2000, respectively, from Cairo University, Egypt. His interested in the field of ultrafast lasers and ultrafast phenomenon. His research plans are devoted to ultrafast optics and photonics: nonlinear interactions of short laser light and matter using time-resolved spectroscopy for laser-pulse durations from nanosecond to few-cycle.

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SPEAKERS

DAY 02

2ND EDITION OF

EUROPEAN LASERS, PHOTONICS AND OPTICS TECHNOLOGIES SUMMIT

05-06 SEPT

Lifeng Yang*, Xin Wei, Zhaojiang Zhang

School of Optoelectronic Information, University of Electronic Science and Technology of China, China

Pulsed photoacoustic non-invassive glucose measurement based on dual - wavelength near infrared differential - absorption method

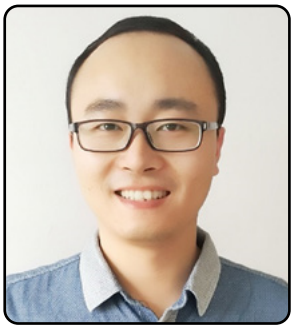
Non-invasive, portable, economical, dynamic blood glucose monitoring device has become a functional requirement for diabetes in his regulating entire life. In Photoacoustic (PA) dual-wavelength near infrared differential-absorption measurement, the glucose in aqueous solutions was excited by two short duration (order of nanoseconds) diode laser pulse system which wavelengths were 1560nm and 1392nm, respectively.The glucose in aqueous solutions to be analyzed was contained within the first Photoacoustic Cell (PAC), whereas the presence of a second reference Photoacoustic Cell (PAC) provided energy monitoring.The PA pulsed signals were measured using a piezoelectric detector and the voltage pulses from the piezoelectric detector were amplified with a precision AC 9452 amplifier, the PA Signal Strength (PSS) was computed as the integration of the Hilbert Transform of the PA signal. To investigate the possible contributions of other blood analytes to the total photoacoustic response from blood, solutions of sodium chloride, cholesterol, and Bovine Serum Albumin (BSA) were investigated.The function generation and signal acquisition were performed in the PC using Lab view software.The experimental results showed that the Photoacoustic (PA) dual-wavelength near infrared differential - absorption measurement can be engineered to detect blood glucose.The results of our study have the potential to not only better develop Photoacoustic (PA) blood glucose meter, but also extend the viability and use of photoacoustic into detection of otherwise blood components.

Audience Take Away:

- Give biomedical photonics researchers a good understanding of photoacoustic detection.
- Dual wavelength differential photoacoustic detection for non-invasive blood glucose technology in this work can be used in real life.
- Improve the range and accuracy of dual-wavelength differential photoacoustics.

Biography

Dr. Lifeng Yang received his BS degree in physics from the University of Electronic Science and Technology of China (UESTC), Chengdu,China, in 2003. He received his MA degree in 2006 and PhD in 2012 in optical engineering from UESTC. Between February 2013 and February 2014, he was a visiting scholar in the Center for Advanced Diffusion- Wave Technologies (CADIFT), University of Toronto, Canada, for research in biomedicalphotoacoustic imaging.He obtained the position of an Associate Professor from 2016 at the UESTC. He has published more than 20 research articles in SCI(E) journals.



Peilong Hong*[1], Willem L. Vos[2]

[1]School of Optoelectronic Science and Engineering,University of Electronic Science and Technology of China (UESTC), China

[2]Complex Photonic Systems (COPS), MESA+ Institute for Nanotechnology, University of Twente, The Netherlands

Light scattering of a single nanoparticle controlled by wavefront shaping

Light scattering by nanoparticles including Mie scattering.is an interesting topic both fundamentally and practically, while the control of the nanoparticle scattering is key for many applications such as controlled light-matter interaction at the nanoscale. In this talk, I will present our theoretical and numerical results of manipulating nanoparticle scattering by wavefront shaping. Although wavefront shaping was initially developed to control light scattering through opaque random media with a large number of scattering nanoparticles, I will show that wavefront shaping is also available for controlling light scattering of a single nanoparticle. I will discuss the strongly scattering eigenchannels hosted by the nanoparticle by analyzing the backscattering matrix of the nanoparticle, which offers the possibility to control light scattering of nanoparticles by individually addressing these eigenchannels through wavefront shaping. Besides, I will show that these scattering eigenchannels are related to different resonant leaky modes of the nanoparticle. Moreover, by analyzing the spectral correlation of these highly scattering eigenchannels, both the short range and the long range correlations exist. These results indicate that wavefront shaping is an efficient method to control light scattering and light-matter interactions with nanoparticles and relevant applications.

Audience Take Away:

- Wavefront shaping is an efficient tool for controlling light scattering by nanoparticles.
- A single nanoparticle hosts multiple strongly scattering eigenchannels.
- The strongly scattering eigenchannels are related to the resonant leaky modes of a single nanoparticle.

Biography

Dr. Peilong Hong received his BS and PhD degree from the NanKai University in 2009 and 2014, respectively. His current research interests include modulation of optical field, optical imaging, and nonlinear nanophotonics. He has published more than 20 research articles in peer-reviewed journals.

Wen Zhou

Key Laboratory for Information Science of Electromagnetic Waves, Fudan University, Shanghai, Shanghai, China

AI techniques for broadband photonics mmw communication towards 6g

5G defines below 100 GHz as the Millimeter-Wave (MMW) bands, whereas 100 GHz - 3 THz is categorized as THz band in 6G. Photonics-aided MMW generation is a key technique in the fiber-wireless network, which overcomes the bottleneck of the deployed electrical devices. Moreover, Deep Learning (DL) is expected to enable a significant paradigm shift in 6G wireless networks. For W-band (75-110 GHz), we proposed a dual Gated Recurrent Unit Neural Network Based Nonlinear Equalizer (dual-GRU NLE) for Radio-Over-Fiber (ROF) communication systems. The dual- equalization scheme is mainly based upon GRU algorithm, which can be trained via two steps including I-GRU and Q-GRU. By using the dual-GRU equalizer, 60-Gbps 64-QAM signal generation and transmission over 10-km SMF and 1.2-m wireless link at 81-GHz can be achieved. For D-band (110-170 GHz), we proposed a novel scheme to effectively mitigate the nonlinear impairments in a PAM-8 Radio-Over-Fiber (ROF) delivery by a Joint Deep Neuron Network (J-DNN) equalizer, which has more superiority in terms of good training accuracy, satisfactory tracking speed, and over-fitting suppression compared with a typical Deep Neuron Network (DNN) equalizer. By using the proposed J-DNN equalizer, 60-Gbps PAM-8 signal generation and transmission over 10-km SMF and 3-m wireless link at 135-GHz can be achieved. Moreover, a novel Complex-Valued Neural Network (CVNN) equalizer using 'CReLU' activation function to directly recover PAM-4 signals from received noised signals is demonstrated. D-band 90-Gbps single channel PAM-4 signal generation and transmission over 10-km SMF and 3-m wireless link at 140-GHz can be achieved. Thanks to the aid of traditional mathematical-oriented models including FOE and CPR, the computation burden of CVNN is released significantly. Furthermore, we compare the performance of CVNN and Real-Valued Neural Network (RVNN) in terms of BER decision accuracy, time complexity and receiver sensitivity. Followed by the same DSP with the same complexity, the comparison result between DNN and CVNN in the same structure shows that CVNN performs better due to its reservation of phase information. Therefore, we believe that the joint use of modelbased, e.g., FOE, CPR steps and complex DL-based techniques has a potential for the future 6G wireless physical layer algorithms.

Audience Take Away:

- Figure out what role Fiber Wireless Communications (FWC) could play in Beyond 5G and 6G Wireless Networks.
- Present our proposed high speed FWC achievements beyond 100 GHz.
- Cover the key challenges and perspectives on machine learning techniques for the future 6G wireless physical layer algorithms.
- Provide a complex-valued deep machine learning scheme for the high speed coherent photonics MMW communication.

Biography

Dr. Wen Zhou received the B.Sc.degree from the Nanjing University of Posts and Telecommunications, Jiangsu, China, in 2009 and the Ph.D. degree from Nanjing University of Posts and Telecommunications in 2016. In 2016, she engaged in the postdoctoral research of photonic aided millimeter wave generation, ROF transmission and detection at Fudan University, Shanghai, China. Since 2021, she has been with Fudan University, Shanghai, China, where she is currently an Assistant Professor, continuing her work on large-capacity photonic MMW and THz transmission technologies with a strong focus on implementations for B5G and 6G. Her research interests include the fields of fiber-optic and wireless communications and the associated digital signal processing. She has published more than 50 research articles in SCI(E) journals.

Jagneet Kaur Anand*[1], Himanshu Kushwah[1], Anupama Sachdeva[2]

[1]Department of Electronics, Keshav Mahavidyalaya, University of Delhi, India

[2]Department of Physics, Keshav Mahavidyalaya, University of Delhi, India

Understanding the performance of surface plasmon resonance based sensors from the first principle

Starting with the basic laws of electricity and magnetism, we study the optical modes associated with the plasma oscillations of the free electron gas on a metal surface in contact with a dielectric layer. We then obtainmathematical equations for these optical modes for optical frequencies above the plasma frequency ωp of thesemetals and discuss its characteristics in detail. These optical modes of plasma oscillations can be excited byresonantly coupling the electromagnetic wave at frequencies above ωp through the evanescent waves penetratingfrom a dielectric in contact with the metal, whose thickness and refractive index are appropriately chosen. Theseoptical modes are transverse magnetic in nature which satisfy certain boundary conditions and propagate along theboundary of metal and dielectric. These optical modes are very sensitive to any microscopic changes that take place in the dielectric region adjacent to the boundary and hence are being widely employed as optical sensors.These optical sensors are based on the principle of Surface Plasmon Resonance (SPR) and hence are named as SPR sensors. The electric field associated with these optical modes propagate in the form of dis-continuous loops along the boundary. Behaviour of the electric field can be described by evaluating the gradient at any point on these dis-continuous electric loops. These plots reveal interesting properties about the electric field associated with these optical plasmon modes at the metal surface, which have pronounced effect on the performance of plasmonic devices. The gradient of the electric field is shown to have a large value at the metal-dielectric interface. The gradient reduces as we move away from the interface. A knowledge of the gradient of the electric flux lines near the metal boundary has proven to be very fruitful in understanding the functioning of optical sensors and can be utilized in optimizing their performance.

Audience Take Away:

- The proposed results can be used to understand the performance of Surface Plasmon Resonance (SPR) based sensor and evaluate its design parameters for desired sensitivity and Figure Of Merit (FOM).
- Commercial applications: The design methodology of SPR affinity bio-sensors can be prepared from the results discussed herein. The choice of the thicknesses and refractive indices of the various materials employed in the SPR sensors, plays a very important role in its performance when used for the detection of bio-molecules such as E-Coli, pseudomonas bacteria, glucose levels, and triglycerides, etc. in the blood sample.
- Applications in Research/ teaching domain: The proposed technique can be expanded to study other optical devices such as the directional couplers which are extensively being used in integrated optoelectronic devices, and optimize its design parameters.
- The optical TE/TM polarizers can also be studied and their extinction ratio be improved by the proper choice of the refractive indices and thicknesses of the various layers using the proposed technique.

Biography

Jagneet Kaur Anand received her B.Sc. degree (July 1992) and M.Sc. degree (July 1994) in Electronics from University of Delhi South Campus, India. She received her M.Tech. in Opto-Electronics and Optical Communication (Dec. 1995) and Ph.D. in Broadband Erbium doped fiber amplifiers (2002) from Indian Institute of Technology, Delhi, India. She joined Keshav Mahavidyalaya, University of Delhi, India, in Dec. 1998, where she is currently a Professor of Electronics. Her current areas of research are Optical waveguides, Erbium Doped Fiber Amplifiers, SPR sensors, and Poynting vector applications in evanescently coupled optical devices.

Sivaperuman Kalainathan
Vellore Institute of Technology, India

Surface modification of ferrous metal alloys by nano-second laser shock peening

Laser Shock Peening is a promising surface enhancement technique applied to variety of metal materials to improve their surface, microstructure and mechanical properties. The induced compressive residual stress through laser shock peening is beneficiary to retard the crack initiation and propagations to extend the fatigue life of the engineering components.

This present work tried to bring necessary developments to implement low energy laser shock peening technique on few ferrous and non-ferrous metal alloys using Q-switched Nd: YAG laser with the fundamental wavelength of 1064 nm. Also, we have implemented laser shock peening without any protective layer coating called laser shock peening without coating technique for cost-effective processing. The work initially tried to optimize the laser pulse density or pulse overlapping to induce maximum compressive residual stress in case of laser shock peening without coating for the metal alloys such as Medium Carbon Spring Steel SAE 9254 and Austenitic Stainless Steel AISI 304. Later, we tried to apply laser shock peening for the severe surface plastic deformations called laser shock surface nanocrystallization by optimizing the number of impacts for the metal alloys Medium Carbon Spring Steel SAE 9254, Duplex Stainless Steel SAF 2205 and Nickel base Super alloy Inconel 718.

This thesis work tried to provide a practical solution to improve the functional life and performance of advanced materials for the desired applications. The work also focuses on bridging the knowledge gaps in understanding the key surface properties resulting from Laser Shock Peening that would aid in improving the key surface microstructure and mechanical properties.The ensuing results are expected to provide not only new and cost-effective pathways for designing and manufacturing engineering components with the required mechanical properties and hence structural integrity and reliability, but also new scientific insights into processing-microstructure-property relationships of these materials, which are all of great importance for cost savings. Such results would be of great utility in engineering, nuclear and biomedical applications. In turn, these advancements are expected to have a cross-cutting impact across all advanced materials and researchers, as well as those in materials processing sector in their development of effective manufacturing methods for advanced materials.

Biography

Prof.S. Kalainathan is currently Professor (Higher Academic Grade), Centre for Nanotechnology Research, VIT University, Vellore, Tamilnadu, India. He received his M.Sc in Physics from the Madras University of Chennai in 1987 and PhD in Materials Science from Anna University, Chennai in 1991. He has been awarded JSPS Invitation Fellowship, University of Tokyo in 2015, Prof.P.Ramasamy National Award for Crystal Growth in 2009, Most Active Researcher Award in 2008 and Best Teacher Award in 1997 by VIT University, Visiting Professor, Akita University in 2014,2017,2018 and 2019. He has published/co-published over 283 journal papers and completed 13 funded projects. He is also an inventor in 6 Indian patents related to laser shock peening. His research interests include crystal growth by Bridgemann and Flux techniques, solar cell, Gas sensor and magnetic memories by thin film, bio-nano materials, artificial biological stones by gel growth techniques and surface medication of metals and alloys by laser shock peening method. He is an executive member of Indian Association for Crystal Growth.

Sanjeeb Dey

Computer Science and Electronics Department, Ramakrishna Mission Vidyamandira, India

A theoretical study on anti-laser with EM perspective

Our study on tunable anti-lasing or commonly known as coherent perfect absorption can be expressed with a simple formula as $\xi=2k_1k_2+i(k_2^2-k_1^2)\ \sin(2k_2d)$for TE-polarization. The expression can be used to estimate all necessary parameters required for anti-lasing, such as, materials type, it's thickness, angle of incidences and wavelength of the light.

Recently, it has been observed that a tremendous interest is found in the anomaly of anti-lasing, particularly in micro or nano-structures, where the incident lights shining from the opposite side of anti-lasing materials are 100% absorbed. The positive imaginary part of a complex permittivity is the essential requirement for absorbing media, which is involved in the occurrence of anti-lasing. Apart from these the dependence of anti-lasing varies with 1: the concentration or density of the medium 2: the wavelength of shining lights, and 3: the angle of incidence of the lights. This theoretical expression can describe all the parameters of anti-lasing. This presentation contains how one can derive the expression from EM waves for oblique incidences with the help of Maxwell's and EM boundary conditions. We will see several examples of anti-lasing with the help of the expression.

Audience Take Away:

- The logical step-by-step argument for the development of the theoretical formula of anti-lasing.
- Comparison of some real-time examples of anti-lasing with the expression.
- The usefulness of the formula to achieve anti-lasing.
- Improvement of accuracy in our anti-lasing experiments.
- The future aspect of the formula.

Biography

Dr. Sanjeeb Dey is working as an assistant professor at Ramakrishna Mission Vidyamandira in Computer Science and Electronics Department.He graduated from Banaras Hindu University (BHU) and got a doctoral degree (Ph. D.) from the University of Hyderabad (UOH) in 2017. He just set up his lab to work on quantum optics in the vicinity of theoretical research, which is actively involved in light-matter interaction, plasmonics in the waveguide, nonlinear optics, meta-materials, etc. in the single or stratified medium.

Karan Surana*[1], Bhaskar Bhattacharya[2], Saurabh S. Soni[1]

[1]Department of Chemistry, Sardar Patel University,India
[2]Department of Physics, Mahila Mahavidyalaya, Banaras Hindu University, India

The dynamic and evolving world of quantum dots

A Quantum Dot (QD) is a semiconductor nanostructure that confines the motion of conduction band electrons, valence band holes, or excitons (bound pairs of conduction band electrons and valence band holes) in all three spatial directions.The quantum confinement results in appearance of discrete energy levels leading to existence of Multiple Exciton Generation (MEG), tunable band gap and size dependent photoluminescence in Quantum Dots (QDs).These semiconducting marvels have been prepared by a variety of material combinations, such as, group II and group VI, group III and group V, and most recently from carbon. We have been able to synthesize a variety of QD such as CdSe, CdS, CdSe-CdS, and Carbon and successfully tested their applications in third generation solar cells. By using only CdSe QD on the photo anode, we have been able to achieve a maximum V_{oc} of 1.51 V. In another study, upon using sequential deposition of different QD we were able to achieve eight times higher efficiency than its corresponding Dye Sensitized Solar Cell (DSSC). Furthermore, the use of C QD in co-sensitized type device resulted in almost three times increase in efficiency than the DSSC. Overall, QD can serve a much wider purpose in establishing better useful devices for everyday applications. Quite recently, we have started working on using the QD to develop in-door photovoltaic based systems.

Biography

Dr. Karan Surana had completed his Ph.D from Sharda University, Greater Noida, India in the field of ‘quantum dot solar cells’, prior to which he obtained his Master’s degree in Nanoscience and Technology. In his 8 years of research work he has gained expertise in synthesis and characterization of quantum dots and carbon materials, and in fabricating solar cells, supercapacitors, and batteries. He has published 19 research papers in international peer reviewed journals, 5 papers in conference proceedings and one book chapter. He is currently working as a UGC-DS Kothari Post-doc fellow at Department of Chemistry, Sardar Patel University, Gujarat.

Apurva Kumari

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

Single image dehazing and defogging for the estimation of optimal transmission map using restoration techniques

Bad weather has an adverse impact on outdoor vision systems and also increases the possibilities of traffic crashes and road accidents. Outdoor images captured in bad weather conditions such as haze and fog are degraded due to the scattering of atmospheric particles. The decreased visibility significantly impacts on driving assistance systems developed for automatic vehicle. So, clear visibility is very essential for the outdoor computer vision systems. Image deweathering is one of the ill posed problems since the transmission depth estimation is very uncertain. Therefore, the most accurate estimation of transmission depth is indispensable. Traditional state-of-the-art restoration techniques frequently generate halo artifacts or reduce the contrast of the observed object in the restored images due to unequal transmission depth distribution. The most difficult aspect of previous state-of-the-art techniques is accurately and effectively estimating the transmission depth from object to object in a short period of time.The restoration-based approaches are used to estimate the refinement of the transmission map to recover scene radiance. The following performance metrics are used for quantitative analysis of the experimental results: contrast gain, blind contrast assessment (e, r), Peak Signal-To-Noise Ratio (PSNR), Structural Similarity Index Measure (SSIM), and Image Visibility Measurement (IVM).

Audience Take Away:

- Scattering phenomenon for atmospheric particles.
- Image degradation model to understand the formation of image in presence of bad weather conditions.
- Image processing algorithms and different approaches would help to researcher or academician to expand their research in different domains. The restoration based methods provides a suitable solutions for real time implementation. The solution will reduce the complexity of processing time and restore the clear and visible 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. 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.

Abdullah S. Karar

College of Engineering and Technology, American University of the Middle East, Kuwait

Digital signal processing for electronic dispersion compensation in Intensity Modulation / Direct Detection transmission

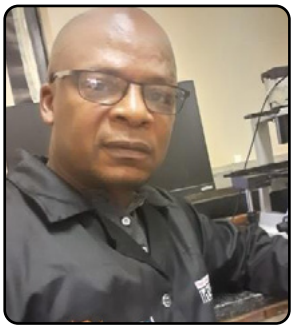
Intensity-Modulation And Direct-Detection (IM/DD) systems deployed for short reach optical fiber links require Electronic Dispersion Compensation (EDC) at the transmitter and/or electronic equalization at the receiver. Under direct detection, the optical phase is lost and complex-valued compensation of Chromatic Dispersion (CD) used in coherent systems could not be adopted. In work, a verity of EDC methods will be presented for both directly modulated and externally modulated lasers.

Audience Take Away:

- Novel DSP implementation of EDC algorithms for intensity modulation and direct detection.

Biography

Dr. Abdullah S. Karar, obtained his Ph.D. from Queen's University, Kingston ON, Canada in electrical engineering with focus on digital signal processing for short reach optical fiber communications in 2013.From 2013 to 2014, he was an NSERC Post-Doctoral Fellow in mathematics and statistics researching coherent optical systems and an Adjunct Assistant Professor in electrical engineering. From 2014 to 2018, Dr. A. S. Karar joined Infinera Ottawa, as a Senior/Staff System Design Engineer working on digital signal processing algorithms for coherent optical transceivers. Since 2018, he has joined the American University of the Middle East in Kuwait, where he is currently an Associate Professor. He is a Senior Member of IEEE and a member of OSA. Dr. Karar, has authored over 80 peer reviewed publications in the areas of optical fiber telecommunications and photonics, and holds 6 US patents. Dr. Karar current research involves electronic dispersion compensation in intensity modulation / direct detection systems and novel digital signal processing algorithms for coherent optical communications.



Sandy Winfield Jere*, Nicolette Nadene Houreld

Laser Research Centre, Faculty of Health Sciences, University of Johannesburg, South Africa

Photobiomodulation at 660 nm enhances cellular viability and proliferation and decreases cellular apoptosis in vitro

Diabetes Mellitus (DM) is often associated with delayed wound healing and non-traumatic limb amputation, mainly due to reduced cell proliferation and viability, and increased apoptosis resulting in deregulated wound healing processes. Apoptosis is responsible for the removal of inflammatory cells and maturation of granulation tissue into scar tissue, and occurs in the late phase of wound healing. The occurrence of apoptosis in the early phase of healing can lead to atypical wound healing due to degradation of granulation tissue as well as fibroblasts and small vessels including endothelial cells. Photobiomodulation (PBM) enhances wound healing both in vitro and in vivo. This technique involves exposing wounded tissue to low level light emitting diodes or lasers. However, at a tissue, cellular and molecular level, the mechanism/s involved after irradiation are not completely understood.

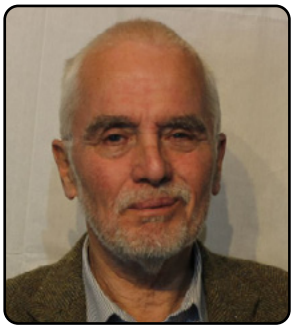
The aim of this study is to evaluate the effect of a 660 nm laser on Diabetic (D) and Diabetic Wounded (DW) human skin fibroblast (WS1) cell proliferation, viability and apoptosis. A diabetic cell model was created by continuously growing cells for several passages in high glucose medium (with an additional 17 mM D-glucose). Wounds were induced in vitro by culturing cells in 3.4 cm diameter culture dishes and performing a central scratch using a 1 mL disposable pipette. Cells were incubated for 24 h after irradiation using a diode laser (660 nm and 5 J/cm^2). Irradiated and non- irradiated cells were evaluated for migration using inverted light microscopy, proliferation using the dimethylthiazol- diphenyltetrazolium bromide (MTT) assay, viability using the trypan blue assay, and apoptosis using the caspase-glo 3/7 assay. Irradiation at 660 nm and a fluence of 5 J/cm^2 had a significant stimulatory outcome on the proliferation rate (P=0.013 and P=0.019, for D and DW respectively) and viability (P=0.016 and P=0.007, for D and DW respectively), and a reduction in caspase-3/7 activity (P=0.001 in D cells). This study shows that a 660 nm diode laser speeds up wound healing under hyperglycemic conditions through enhancing/stimulating cellular viability and proliferation, and decreasing cellular apoptosis, and could be useful in chronic diabetic wound healing.

Audience Take Away:

- PBM using red light can induce hastening of the wound healing process in diabetes mellitus.
- A 660 nm diode laser at a fluence of 5 J/cm^2 can effectively promote skin wound healing in diabetes mellitus.
- A 660 nm diode laser at a fluence of 5 J/cm^2 can effectively accelerate fibroblast cell proliferation and viability in diabetic wound healing.
- A 660 nm diode laser at a fluence of 5 J/cm^2 can effectively reduce fibroblast cell apoptosis in the early phase of diabetic wound healing.
- From this presentation the audience will be able to know that PBM can be effective for wound healing and other typesof skin injury. This treatment method is non-thermal with no side effects, and could be used as an adjunct to other conventional treatment methods for diabetic wound healing.
- PBM therapy can reduce treatment costs for chronic diabetic wounds and non-traumatic limb amputations, and can easily be a widely available treatment method.

Biography

Dr Sandy Winfield Jere is a Post Doctorate Research Fellow at the Laser Research Centre (LRC), Faculty of Health Sciences, University of Johannesburg, South Africa. He is a Malawian, and was first registered with the University for a Master degree in February 2016. His research work focusses on the effects of Photobiomodulation in diabetic wound healing, specifically on the activation of kinases and signalling pathways involved in wound healing. Since he joined the LRC, Dr Jere has worked on two projects entitled "The effect of Photobiomodulation at 660 nm on the JAK/STAT signalling pathway in diabetic wounded fibroblast cells in vitro" and "Influence of Photobiomodulation at 660 nm on the PI3K/AKT/mTOR signaling pathway in wound healing of hypoxic diabetic human skin fibroblasts". As a Post Doctorate fellow, Dr Jere is working on a project entitled "Impact of Photobiomodulation at 660 nm on the Expression of Basic Fibroblast Growth Factor and Activation of the Canonical Wnt/β-Catenin Pathway in Wounded Diabetic Fibroblasts".



Ben Campbell Biezanek*, Church Stretton
Distinguished Researcher, United Kingdom

Quantum-Relativity

This lecture in Quantum-Relativity describes what you should have been taught about relativity very early on in your physics higher education. As quantum physicists, you will benefit from understanding why the quanta transit time takes longer than expected in passage through transparent media (glass etc.). Quantum-Relativity has huge implications in the field of astro physics and cosmology. However, Quantum-Relativity can only be presented to quantum physicists because our Cosmologists and Astro Physicists are living in a kind of "cloud cuckoo land" trance state and have blocked themselves from the logic of quantum-relativity. Understanding Quantum-Relativity requires a good basic understanding of both Einstein's General Theory and his Special Theory. The General Theory, as we now know it, turns out to be correct but the Special Theory of Relativity becomes modified by a proper and workmanlike understanding of time. Einstein only understood time from a classical perspective, he did not understand time from a quantum perspective. Now this can be rectified, resulting in the huge benefit that theoretical physics suddenly makes complete and unified sense. Before the discovery of Quantum-Relativity, our theoretical physics made no overall sense what so ever. I am sure that there is no need for me to tell quantum physicists that the quantum view of relativity and time is the correct one and that the classical view of time (and therefore of relativity) that Einstein described was quite clearly incorrect.

Biography

The author is 72 years old; he is happily married (but also happily separated) with four sons and ten grandchildren. The author discovered the key solution that led to what he only now calls Quantum-Relativity 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 specialized 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 byproduct of that overall work, to the development of what he now names as Quantum-Relativity.

Muhammad Sajid Khan
University of South Wales, United Kingdom

Gender identification using 3D eyeball pupil model

3D iris recognition is one of the most reliable techniques for identifying the gender of individuals. Each iris consists of an inner and outer circular looking area. The outer area does not change in size, while the inner area can change in size and appearance over time. These changes in the inner area make it difficult to use in biometric recognition and authentication systems. The centre of the iris is called the pupil, an opening through which light passes. The iris adjusts the size of the pupil to control the amount of light that enters the eye. In the system detailed here, the pupil is estimated as the main feature and calculated as a reference in the system to recognise the gender. It works on the pupil of the iris to measure the diameter of the targeted pupil and identifies the gender of the input image from the standard dataset. The proposed system produces accurate results and more usability in the system. The proposed system offers a simplistic technique and does simple formulas calculations compared to the classification using the Low Binary Pattern (LBP), texture patterns and five-layer deep convolutional neural network. The system has been tested using the Multimedia University Iris database and classified individuals in images as either male or female with an accuracy rate of 92%.

Fatemeh Sadat Mousavinejhad *, Mehdi Fatehi Nia

Faculty of Mathematical Sciences, Yazd University, Yazd, Iran

Saccadic model and sigmoidal functions

One of the eye movements that led to the creation of the saccadic model is the saccade. This research relies on burst neurons and a resettable integrator model, which are the cornerstones of the saccadic system. We provide one of the most effective new functions for the right and left burster responses, based on particular Naka-Rushton functions and specific sigmoid functions, which can solve the problem of the main model's lack of equilibrium point. The phase portrait, the occurrence of the bifurcation, and the time series are some of the important dynamical properties that will be investigated.

Sara Ezairi*, Assaad Elouafi, Fatima Lmai, Abdesslam Tizliouine

LPMAT, Faculty of Sciences Ain Chock, Hassan II University of Casablanca, Morocco

LMPGI, Ecole Supérieure de Technologie, Hassan II University of Casablanca, Morocco

Optical properties, Influence of the polarization and the temperature on heterojunction organic solar cell

We investigate the dark current-voltage properties of P3HT: PCBM based solar cell at different temperatures. The experimental data were fitted using two methods: Analytical Lambert Method, and Two Regions Method. Several electrical parameters such as: ideality factor n, series resistance Rs and shunt resistance Rsh were determined. The ideality factor for this device is bigger than unity which is discussed in terms:

(i) existence of trap levels due to impurities in the band gap and

(ii) the presence of tunneling conduction. It is shown that the J-V curves are driven by different effects depending on voltage and temperature ranges. By fitting the temperature dependence of the equivalent circuit's, we extract many essential parameters such as: potential barrier (Φb), Poole Frenkel coefficient βp, mobility μ, and carrier concentration. It is shown that at low temperature the transport properties are governed by Schottky effect while at high temperature the Poole-Frenkel effect is prevailing.

Audience Take Away:

- Energy harvesting from sunlight is important for saving fossil fuels, which are found to be in a limited quantity in the universe. Photovoltaic devices transforming light into electricity are presently fabricated by semiconductors.
- However, the main disadvantage of these semiconductor photovoltaic devices is the cost, where their price/efficiency combination cannot compete with other sources of electricity. Organic photovoltaic appear to be a good alternative for reducing the cost of photovoltaic devices since they are uniquely cheap.
- We discuss the electrical and optical properties, of the sample structure P3HT: PCBM which provide information on the absorption of each material, and therefore on the performance of devices and also, the limits to be respected to improve the efficiency of these devices.

Biography

Dr. Sara EZAIRI :Phd student in materials physics since October 2021 at Faculty of Sciences Ain Chock, Hassan II University of Casablanca, Morocco, she is working on nanomaterials by studying their optical, electrical and magnetocaloric properties in Laboratory for Advanced Materials Physics and Thermal in collaboration with Laboratory of Mechanics, Productics and Industrial Engineering .She has been contributed to 9 international conferences, and has been a member of the organizing committee of 2 conferences.

B. Kahouadji [1]*, L. Guerbous[2], Dragana J. Jovanović[3], Miroslav D. Dramićanin[4]

[1]Department of technology, University of Bejaia, Algeria

[2] Laser Department/ Nuclear Research Center of Algiers (CRNA), Algeria

[3]Vinča Institute of Nuclear Sciences, University of Belgrade, Serbia

Enhancement of photoluminescence properties of nano-sized Pr^{3+} doped $LuPO_4$ powders by incorporating of Y^{3+} ions

The work explores the enhancement of photoluminescence properties of nano-sized $LuPO_4:Pr^{3+}$ phosphor powders synthesized by sol gel process with incorporation of yttrium ions inside of this single matrix to obtain $(Lu_{1-x}Y_x)PO_4:Pr^{3+}$ (x=10, 20, 30, 40, 50 at. %) powders.Under UV excitation at 270 nm the emission spectra of $LuPO_4:Pr^{3+}$ nanopowder do not present any characteristics emission band attributed to $4f^15d^1 \rightarrow 4f^2$ transitions of Pr^{3+} ions, while a large emission band has been observed which due to defects created in $LuPO_4$ cell by doping considering the ionic radius of Pr^{3+} is larger compared to the ionic radius of Lu^{3+}, this band extinguishes gradually at the time insertion of the Y^{3+} ions until its total disappearance (for x=40 at. %).It was found that the emission spectra of $(Lu_{1-x}Y_x)PO_4:Pr^{3+}$ nanopowders under λ_{ex}=230nm presents only the characteristics emission bands of Pr^{3+} ions with a remarkable influence of the rate of Y^{3+} ions on the intensity of this bands.Furthermore, it was observed that the improvement in the luminescence properties of $(Lu_{1-x}Y_x)PO_4:Pr^{3+}$ nanopowders is very remarkable in visible range.

Biography

Dr. Kahouadji has a PhD in physics, option: physics of materials since April 2017, teacher researcher at A.Mira university of bejaia, faculty of technology. He is working on nanomaterials based on rare earth orthophosphates in collaboration with two laboratories:Laser Department/ Nuclear Research Centre of Algiers (CRNA), Vinča Institute of Nuclear Sciences, University of Belgrade.

Participants List

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September 2023 | Hybrid Event

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