SCHOLARS CONFERENCES

3rd Edition International Conference on

OPTICS, LASERS AND PHOTONICS

March 25-26, 2024 | Barcelona, Spain

Contact Us:
David Bishop
Program Manager | Opics-Laser 2024
david@scholarsevents.org
21 Clifton Road, Newcastle Upon Tyne, England |
UK, NE4 6XH
+447426060443
https://scholarsconferences.com/optics-photonics-lasers/

SCIENTIFIC PROGRAM

Day 01 | March 25, 2024 | Salon Sena

08:30-09:30	Registrations
09:30-09:45	Opening Ceremony
Keynote Forum	
09:45-10:20	**Title: High-speed 3D Imaging and Metrology: From Classical Fringe Projection to Deep Learning Approaches** **Chao Zuo**, Nanjing University of Science and Technology, China
10:20-10:55	**Title: On the Internal Structure of the 'Enigmatic Electrons'** **Natarajan T S**, Indian Institute of Technology, India
Networking and Refreshments Break @ Foyer 10:55-11:15	
11:15-11:50	**Title: Light and Tetrapyrroles Against Antibiotic-Resistant Microbes** **Ludmil Benov**, Kuwait University, Kuwait
11:50-12:25	**Title: Reducing Laser Beam Fluence and Intensity Fluctuations in Symmetric and Asymmetric Four Grating Compressors** **Efim Khazanov**, IAP RAS, Russia
12:25-13:00	**Title: Can Nanomedicine Change Occupational Health?** **Maria Cecilia Colautti**, National Defense University, Argentina
Group Photo @ 13:00-13:10	
Lunch Break: 13:10-13:50	
Speaker Session:	
Session Chair: Ludmil Benov, Kuwait University, Kuwait	
13:50-14:15	**Title: In-operando Affinity Profiling of Peptide-based Biorecognition Elements for Selective Volatile Organic Compound Sensors** **Steve Kim**, USAF/AFRL (Air Force Research Laboratory), USA
14:15-14:40	**Title: The Universe Computes Hypothesis and Its Implications for The Theory of Everything** **Ediho Lokanga**, ONCAMPUS Aston, UK
14:40-15:05	**Title: Synthesis, Characterization and Photocatalytic Evaluation of Nanoparticles of Nickel Titanate ($NiTiO_3$) and Nickel Titanate/Titanium Dioxide ($NiTiO_3/TiO_2$) composites** **Alberto Bacilio Quispe Cohaila**, Jorge Basadre Grohmann National University, Peru
15:05-15:30	**Title: Quantum Transmission Through A self-similar Two Dimensional Structure** **Aparna Nihaldaran**, Loughborough University, UK
15:30-15:55	**Title: Modeling of Electron-Electron Scattering Nanoelectronic Devices** **Hans Kosina**, Vienna University of Technology, Austria
Networking and Refreshments Break @ Foyer 15:55-16:10	
16:10:16:35	**Title: Preparation and Characterisation of Polyethylene/Porous Filler Composites as Potential Low Insulation Materials** **Chulin Jiang**, Teesside University, UK
16:35-17:00	**Title: Single Cell Ionization using Laser Trapping Technique and Its Possible Biomedical Application** **Bekalu Melaku**, Addis Ababa University, Ethiopia
17:00-17:25	**Title: Optimisation of Bioactivity and Mechanical Properties of Zirconia/Hydroxyapatite Composites for Dental Implant** **Zhongyuan Xing**, Teesside University, UK

17:25-17:50	**Title: Measurement of Photo Ionization Cross- Section of Auto Ionizing States of Xenon by Using Optogalvanic Spectroscopy** **Waqas Yousaf**, Quaid-I-Azam University, Pakistan
17:50-18:15	**Title: Challenges, opportunities, and innovative technologies for biofuel production and sustainable environmental management** **Eslam A. Mohamed**, Egyptian Petroleum Research Institute, Egypt
18:15-18:40	**Title: Electron-phonon Coupling Laser Crystal Research** **Zhonghuan Zhang, Universitat Rovira i Virgili, Spain**

Poster Presentation @ 18:40-19:10

P0101	**Title: Design of Novel Polyurethane-based Ionene Nanocarriers for Cancer Therapy: Synthesis, In-Vitro, and In-Vivo Studies** **Athar Mahdieh**, University of Oslo, Norway
P0102	**Title: Sources of Classicality in Linear Optics: A Diagrammatic Perspective** **Lucia Tormo**, University of Barcelona, Spain
P0103	**Title: Single-frame Interference Phase Retrieval Method Based on Virtual Phase Shift** **Yan Zhao**, Institute of Optics and Electronics, Chinese Academy of Sciences, China
P0104	**Title: Comprehensive Characterization of (Bi0.5Ba0.5Ag)0.5(NiMn)0.5O3 Perovskite Ceramic: Structural, Dielectric, and Electrical Insights** **Kais Iben Nassar**, University of Aveiro, Portugal

Panel Discussions

Day 01 End | Closing Ceremony

Day 2 | March 26, 2024 | Virtual | GMT+2

09:15-09:30 : Introduction

Keynote Forum

09:30-10:00	**Title: Quantum Entanglements and Operations for Programmable Quantum Computers** **Wanyang Dai**, Nanjing University, China
10:00-10:30	**Title: Newly Discovered Topological Theory of Quantum Gravity (TTQG) - A Multiblock Compatibilizer-Cum Modifier of the Existing Theories of Physics, Cosmology, Quantum Mechanics and Quantum Computing** **Chinmoy Bhattacharya**, APC Private Ltd, India
10:30-11:00	**Title: Shape Reversibility and Diffraction Studies in Copper Based Shape Memory Alloys** **Osman Adiguzel**, Firat University, Turkey
11:00-11:30	**Title: Fabrication of Waveguides with High Optical Confinement and Application to Future High-Capacity Networks** **Masayuki Itoh**, Tokyo University of Technology, Japan

Refreshments Break @ 11:30-11:40

11:40-12:10	**Title: Newly Synthesized Second-Generation Dendrimers on Human Fibroblasts and the Mechanism of Their Cellular Uptake** **Aneliya Kostadinova**, Institute of Biophysics and Biomedical Engineering Bulgarian Academy of Sciences, Bulgaria
12:10-12:40	**Title: A Crucial Tool in the Characterization of Quantum Dots** **Kirti Sharma**, Birla Institute of Technology, India
12:40-13:10	**Title: Liquid Crystal Photoalignment by Azodye Nanolayers: New Liquid Crystal Photonics Devices** **Vladimir G Chigrinov**, HKUST, Hong Kong

Speaker Session

Session Chair: Ludmil Benov, Kuwait University, Kuwait

13:10-13:30	**Title: Gamma Radiation: Implications for Respiratory Health _ Azores** **Maria Meirelles**, University of the Azores, Portugal
13:30-13:50	**Title: Friction and Wear at the Nanometer Scale: Identification and Control of the Governing Mechanisms** **Arnaud Caron**, KoreaTech - Korea University of Technology and Education, South Korea

13:50-14:10	**Title: The Innovation Pool: A New Model for Open Innovation** **Derrek Luke**, University at Albany, USA
14:10-14:30	**Title: Surprises in the Lunar-Laser-Ranging-Data** **Hans Deyssenroth**, Individual Researcher, Germany
	Refreshments Break @ 14:30-14:40
14:40-15:00	**Title: Graphene Protrusion for Hydrogen Storage** **Omkar Charapale**, Deakin University, Australia
15:00:15:20	**Title: Structural and Thermal Relaxation in Binary Ge-Te Chalcogenide Glass** **Yashika Sharma**, Foserra Photovoltaic Pvt Ltd, India
15:20-15:40	**Title: Integrating Surrogate Modelling Techniques for Enhanced Fusion Plasma Control and Predictability** **Amrita Ghag**, The Knowledge Society, Canada
15:40-16:00	**Title: Tuning Silicon Nanophotonics for Nanotechnology, Biophotonics, and Biotechnology Applications Based on Multicolored Enhanced FRET Light Delivery** **Guillermo Bracamonte**, National University of Cordoba (UNC), Argentine
	Refreshments Break @ 16:00-16:10
16:10-16:30	**Title: Antibacterial and Antiphotoageing Agents: Zein-based Nanoparticles Encapsulating Lupulone** **Mihaela Leonida**, Fairleigh Dickinson University, USA
16:30-16:50	**Title: Condensed Matter Physics Simulation to Measure Cosmic Ray Distributions on an MKID Instrument** **Abhinav Ganesh**, USSB, USA
16:50-17:10	**Title: Towards a Self-driving Lab for Nanoparticle Research** **Mark S Kozdras**, Natural Resources, Canada
17:10-17:30	**Title: Mass Production of Meta-Optics in the Visible to Near Infrared by NIL Patterning** **Bradley Williams**, Moxtek, USA
17:30-17:50	**Title: Study of Optical Limiting Properties in DNA-based Materials Functionalized with Turmeric Dyes** **Petronela Gheorghe**, National Institute for Laser, Plasma and Radiation Physics, Romania
17:50-18:10	**Title: Frontiers in Microfluidics** **Iuliana Urzica**, National Institute for Laser, Plasma and Radiation Physics, Romania
EP-18:10-18:20	**Title: Cylindrical Dust Acoustic Shock Waves in a Self-Gravitational Magnetized Dusty Plasma Compared with Black Hole Plasma** **Moufida Laghbeche**, Hassiba Benbouali University of Chlef, Algeria
	Day 02 End | Closing Ceremony

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KEYNOTE SPEAKERS Day 1

Chao Zuo
Nanjing University of Science and Technology, China

Biography

Chao Zuo is a professor in optical engineering, Nanjing University of Science and Technology (NJUST), China. He leads the Smart Computational Imaging Laboratory at the School of Electronic and Optical Engineering, NJUST, and is also the founder and director of the Smart Computational Imaging Research Institute of NJUST. He has long been engaged in the development of novel Computational Optical Imaging and Measurement technologies, with a focus on Phase Measuring Imaging Metrology. He has published > 200 peer-reviewed articles with over 13,000 citations. These researches have been featured on journal cover (including Light, Optica, LPR, PhotoniX, AP, etc.) over 30 times. He currently serves as an Associate Editor of PhotoniX, Optics and Lasers in Engineering, IEEE Transactions on Computational Imaging, etc. He is a Fellow of SPIE and Optica, and listed as a Clarivate Highly Cited Researcher.

High-speed 3D imaging and metrology: from classical fringe projection to deep learning approaches

With the rapid development of optoelectronic information technology, three-dimensional (3D) imaging and sensing has become a research forefront in optical metrology. Fringe projection profilometry (FPP) is one of the most representative 3D imaging technologies due to its non-contact, high-resolution, high-speed, and full-field measurement capability. In recent years, with the rapid advances of optoelectronic devices and digital signal processing units, people subsequently set higher expectations on FPP: it should be both “high precision” and “high speed”. While these two aspects seem contradictory in nature, “speed” has gradually become a fundamental factor that must be taken into account when using FPP, and high-precision 3D reconstructioan using only one single pattern has been the ultimate goal of structured light 3D imaging in perpetual pursuit. Nowadays, deep learning technology has fully “permeated” into almost all tasks of optical metrology. In this talk, we introduce our recent efforts to apply deep-learning approaches to FPP. We show that the deep-learning-enabled fringe analysis approach can significantly boost the accuracy and improve the quality of the phase reconstruction compared to conventional single-fringe phase retrieval approaches. Deep learning can also be used to achieve single-frame, high-precision, unambiguous 3D shape reconstruction, which is expected to fill the speed “gap” between 3D imaging and 2D sensing and enables FPP techniques to go a step further in high-speed and high-accuracy 3D surface imaging of transient events.

Natarajan T S
Indian Institute of Technology Tirupati, India

Biography

A dynamic academician was a Professor in Indian Institute of Technology (IIT), Madras for four decades till 2015. Currently he is an Adjunct Professor at IIT, Tirupathi, after serving as its first Registrar in-charge, Dean, International and Alumni Affairs and Governing Board Member. He was a Visiting Professor at various universities in Canada, Malaysia, Taiwan, etc., He has delivered 40 lectures under NPTEL program of IIT and was eventually listed among Top 10 most popular Professors on YouTube by New York Times in 2010. His Physics Lecture Demonstrations are very popular among schools and colleges all over India.

On the Internal Structure of the 'Enigmatic Electrons'

Quantum Mechanics (QM) and (Special) Relativity (SR) have indeed revolutionized the very thinking of physicists and the spectacular successes achieved over a century due to these two theories are mindboggling. However, there is still a strong disquiet among some physicists. While the mathematical structure of these two theories have been established beyond any doubt, their physical interpretations are still being contested by many. Even after hundred years of their existence we cannot answer a very simple question, "what is an electron"? Physicists are struggling even now to come to grips with the different interpretations of Quantum Mechanics with all their ramifications. However, it is indeed strange that the (special) relativity theory of Einstein enjoys many orders of magnitude of "acceptance", though both theories have their own stocks of weirdness in the results, like time dilation, mass increase with velocity, collapse of the wave function, quantum jump, tunnelling, etc. Here, in this paper it would be shown that by postulating an intrinsic internal motion to these enigmatic electrons, one can build a consistent picture of reality, revealing a very simple picture of nature. This is also evidenced by the Schrodinger's 'Zitterbewegung' motion about which so much have been written. This leads to a helical trajectory of electrons when they move in a laboratory frame. It will be shown helix is a three-dimensional wave having all the characteristics of our familiar 2D wave. Again, helix being a geodesic on an imaginary cylinder, supports 'quantization', and its representation is just the complex exponentials matching with the wave function of quantum mechanics. By postulating the instantaneous velocity of the electrons to be always 'c', the velocity of light, the entire relativity comes alive, and we can interpret the 'time dilation', 'mass increase with velocity', etc., in a very simple way. Thus, this model unifies both QM and SR without the need for counter intuitive postulate of Einstein about constancy of velocity of light for all inertial observers! After all, if the motion of an inertial frame cannot affect the velocity of light, the converse that this constant also cannot affect the events in the frame must be true. But entire relativity is about how 'c' affects time, length, mass etc., in different frames.

Ludmil Benov
Kuwait University, Kuwait

Biography

Ludmil Benov is a full Professor in Biochemistry and editor of "Medical Principles and Practice". He is graduate of Sofia University (Biochemistry) and obtained a specialty of Biophysics and a Ph. D. degree from Medical Academy, Bulgaria. In 1988 was appointed as a chairman of the Department of Biophysics at Faculty of Medicine, Stara Zagora, Bulgaria. After receiving a Fogarty International Fellowship award was invited by Irwin Fridovich at Duke University Medical Center, USA, where he did research on oxidative cell damage and mechanisms of antioxidant defense and worked on development and characterization of porphyrin-based superoxide-dismutase mimetics and photosensitizers. From 1998 is a professor at the Faculty of Medicine, Kuwait University.

Light and tetrapyrroles against antibiotic-resistant microbes

Widespread resistance to currently available antibiotics has created a strong demand for new methods for therapy and disinfection. A promising alternative approach for eradication of antibiotic-resistant strains is photodynamic inactivation of microorganisms (PDI). It is based on the use of a photosensitizer, a photosensitive compound which upon illumination with visible light, generates reactive species capable of killing bacteria and fungi. Since such reactive species are short-lived in biological environment, only structures in close proximity of the photosensitizer are affected. The number and variety of damaged cellular targets depend on the properties of the photosensitizer and determine the PDI efficacy and possible development of microbial residence. Among the requirements for a potent, medically applicable photosensitizer are high singlet oxygen quantum yield, high antimicrobial activity, and low toxicity to the host. Here the influence of structural factors on quantum yield, cellular uptake, subcellular distribution, and photodynamic antimicrobial activity will be discussed. This presentation will describe the possibilities for development of resistance, the photoinactivation of antibiotic-resistant strains, potential microbial photodynamic targets and the effect of photosensitizer's lipophilicity, total charge, spatial distribution of charges, and three-dimensional shape of the molecule on PDI efficacy.

Efim Khazanov
Institute of Applied Physics of the Russian Academy of Sciences, Russia

Biography

Efim Arkadyevich Khazanov was born on November 12 , 1965 , Gorky. He is a Russian physicist , specialist in the field of laser physics and nonlinear optics , corresponding member of the Russian Academy of Sciences (2008), academician of the Russian Academy of Sciences (2019). Chief researcher of the Federal Research Center of the Institute of Applied Physics of the Russian Academy of Sciences , head of the laboratory "Physical methods, acousto-optical and laser equipment for problems of diagnosis and therapy of oncological diseases" NUST MISIS .

Reducing laser beam fluence and intensity fluctuations in symmetric and asymmetric four grating compressors

For reducing beam fluence fluctuations in high power femtosecond lasers an asymmetric four grating compressor is considered. Diffraction gratings in two pairs are different, whereas all the other parameters are the same. However, this effect was investigated only numerically. In the presented paper, an analytical theory has been constructed that describes all space-time coupling effects arising in an asymmetric optical compressor, in which pairs of gratings may differ not only by the distance between the gratings but also by the groove density and angle of incidence. It has been shown that no compressor asymmetry affects the far field fluence and on-axis focal intensity.

In an asymmetric compressor, there are two effects proportional to the first power of the transverse wave vector. The spatial noise i) lags behind/overtakes the main pulse, which is equivalent to a linear spatial chirp, and ii) acquires a temporal chirp, which is equivalent to a squared spatial chirp. Exact expressions for the fluence fluctuation spectrum and fluence rms have been obtained. By choosing adequate grating parameters it is possible to control these two effects independently, e.g., for creating complex space-time field distributions in the focal plane.

The asymmetric compressor is also interesting for suppressing small-scale self-focusing, e.g., at subsequent post-compression. In this case, it is necessary to reduce the noise intensity rather than its fluence. The constructed theory showed that suppression may be orders of magnitude, even with a slight asymmetry of the compressor.

Maria Cecilia Colautti
University of the Argentine Army, Argentina

Biography

Maria Cecilia Colautti is Doctor of Medicine from the Inter-American Open University (UAI), Postgraduate Studies in Pain Medicine from Favaloro University. Specialist in Occupational Medicine from the Medical College of the Province of Buenos Aires. Specialist in Forensic Medicine from the Argentine Catholic University (UCA) Master's degree in Occupational Health and Safety, Prevention of Occupational Risks in Polytechnic University of Catalonia. She is Full Professor in the Master's Program on Safety, Health, and Hygiene at the Faculty of Engineering of the Argentine Army. National Defense University. She has an extensive professional experience focused on integrated management systems in Safety, Health, Environment, and Quality processes. Certification in ISO 9001, ISO 45001, ISO 14001, ISO 18001, Occupational Safety and Health. ISO 14000 Environmental Management. TC 22000 Certification in Food Safety Management Systems.

Can Nanomedicine change Occupational Health?

Nanomedicine, the application of nanotechnology in medicine, has the potential to revolutionize the way we diagnose, treat, and prevent disease. While the use of nanomedicine is gaining momentum in clinical settings, its use in occupational health is relatively unexplored. The small size of nanoparticles used in nanomedicine allows them to bypass biological barriers, which could pose occupational health risks if inhaled or absorbed through the skin. However, with appropriate risk management strategies and monitoring, the potential benefits of nanomedicine in occupational health could be significant. Nanoparticles could be used for targeted drug delivery, imaging, and sensing, among other applications. In addition, nanomedicine could help address occupational health challenges, such as exposure to hazardous substances and the need for more precise and personalized medicine. This abstract highlights the potential for using nanomedicine in occupational health and underscores the need for further research and development in this field.

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SPEAKERS
Day 1

Steve S. Kim
Air Force Research Laboratory, USA

Biography

Kim is currently serving as a Physical Scientist within the Airman Biosciences Division. After completing National Research Council Postdoctoral Fellow (2007-2010), Dr Kim continued to work as a contract research scientist at AFRL (2010-2016). Dr Kim's research interest is developing electronic / electrochemical / optical molecular biomarker and chemical sensors for human performance monitoring and force health protection. He leads research on developing an electronic biosensor platform for trace level cognitive molecular biomarkers, a crucial piece of information to increase the human performance monitoring / assessment capability for the USA Air Force (USAF). His pioneering nano material study and analytical strategy have unveiled the governing factors in the Nano-Bio interface. Dr Kim has authored and coauthored 63 peer-reviewed scientific journal articles including his main-authored AFRL works that were recognized as a "Top20 most read article on the web in a year" and a "Top20 most read article on the web in a month" in a high impact journal, Nano Letters.

In-operando Affinity Profiling of Peptide-based Biorecognition Elements for Selective Volatile Organic Compound Sensors

Biorecognition elements (BREs) are biological materials exhibiting specific affinity to target molecules. Short peptides (generally composed of 5-15 amino acid residues) are promising BREs for selective VOC detection. They provide chemical stability and design flexibility to sensing the target biomarker. Peptide BRE-coated CNT chemiresistors have emerged as miniaturized sensor platforms for wearable applications. Previous peptide-functionalized CNT gas sensors have shown detection of explosives and bacterial food contamination by products. Selective detection of VOCs in breath remains a technical challenge since many VOCs share similar chemical characteristics such as polarity and partition coefficient. To facilitate discovery of peptides selective towards target VOCs, it is important to investigate a wide range of molecular properties relating to the peptides and VOCs. Here, we present an in-operando approach to investigate peptides' affinity towards VOCs of interest on a CNT chemiresistor. CNT was functionalized by a number of peptides, and VOC sensing events have been directly observed by measuring changes in the electrical properties of the CNTs. We tested tens of peptides that were obtained from phage display, microarray, and/or in-silico modelling. The results showed not only decisive discrimination of the different breath-related VOCs, but also possible peptide sensing mechanism of a peptide-CNT pair. The proposed in-operando BRE investigations have potential for selective breath monitoring electronic-noses facilitating real-time human health and performance assessment.

Ediho Lokanga
Oncampus Aston, UK

Biography

Ediho Lokanga is a theoretical physicist, computer scientist and writer. He was Born in the Democratic Republic of the Congo (DRC), he read physics at the Open University and graduated with a BSc (honours). He went on to complete an MSc in computing at Birmingham City University. Lokanga holds a PhD in the interdisciplinary study of theoretical physics from Euclid; currently, Lokanga lectures in physics at ONCAMPUS Aston University, Birmingham, in the UK. His research interests lie in the diverse areas of quantum theory, quantum information, quantum computing, self-organization, and consciousness.

The Universe Computes Hypothesis and Its Implications for The Theory of Everything (ToE)

The last fifty years, several theories of everything (ToE) or the final theories have been put forward. A new model called the computational theory of everything has been taking shape recently. The model is based on the interdisciplinary field of the physics of information, computation, self-organization, and consciousness. It suggests that the universe computes and is a self-computing consciousness. Therefore, this article discusses the concept of the universe computers and its implications for the ToE, building on the five postulates of the physics of information, computation, self-organization, and consciousness put forward by the author. It also answers various questions on how such a theory can be achieved. Early results from a handful of researchers suggest that it is possible to put forward a computational theory of everything where consciousness plays a fundamental role in the running of the universe. The writer argues that computing permeates the universe and drives every action. Everything in the universe, from atoms to molecules, wherever they are, is performing computation. Every constituent of the universe is manipulating information continuously. For instance, when two atoms collide, each shares and registers information that is then transformed and processed. Each atomic combination performs computation. The outcome of any reaction is known in advance during the physical or chemical processes. Are atoms embedded with intelligence or a lower form of consciousness? Is consciousness fundamental? In what follows, the author attempts to answer several questions this article raises.

Alberto Bacilio Quispe Cohaila
Jorge Basadre Grohmann National University, Peru

Biography

Alberto is an Industrial Engineer, specialty Materials Science, Metallurgical Engineer. Principal undergraduate and graduate teacher at the Jorge Basadre Grohmann National University of Tacna, Peru, in the Faculty of Engineering, School of Metallurgical Engineering. Foreign researcher in the field of Materials at the National Center for Metallurgical Research (CENIM-CSIC, Spain). Foreign Research Professor in Undergraduate and Postgraduate Studies at the Technical University of Oruro, Faculty of Metallurgical Engineering, Bolivia. Guest professor at Universities in the Country in Master's and Doctoral postgraduate courses.

Synthesis, characterization and photocatalytic evaluation of nanoparticles of Nickel Titanate ($NiTiO_3$) and nickel titanate/titanium dioxide ($NiTiO_3/TiO_2$) composites

Nickel titanate ($NiTiO_3$) and nickel titanate/titanium dioxide ($NiTiO_3/TiO_2$) composites were synthesized by the sol-gel method, varying the stoichiometric ratio to obtain NiTiO3 and different NiTiO3/TiO2 nanocomposites. The nanoparticles calcined at 600°C form a crystalline structure and eliminate impurities, especially organic ones. The nickel titanate and $NiTiO_3$/TiO2 composites were characterized by thermogravimetric/differential thermal analysis (TGA, DSC), Raman Spectroscopy, X-Ray Diffraction (XRD), UV-Visible Spectrometer, and Scanning Electron Microscope (SEM). The SEM revealed the agglomeration and nanoparticle sizes of the nickel titanate and NiTiO3/TiO2 composites. The nickel titanate and NiTiO3/TiO2 composite nanoparticles were used to observe the photocatalytic activity in the degradation reactions of Rhodamine B and Methyl Orange under ultraviolet light irradiation. The results of the photocatalytic activity show that the degradation process takes around 6 hours, with the most efficient samples being 3% and 20% TiO2 composites, for Rhodamine B and Methyl Orange respectively. This demonstrates that the $NiTiO_3/TiO_2$ nanocomposites exhibit photocatalytic activity for the degradation of dyes, suggesting these obtained nanocomposites are potential candidates for application in hydrogen generation.

Aparna Nihaldaran
Loughborough University, U.K

Biography

Aparna Nihaldaran obtained her bachelor's degree in physics from Loughborough university. Currently she is obtaining her postgraduation in advanced physics at Loughborough university. Some of her past undergraduate projects were in quantum transmission in a crystal structure and application of quantum anomaly detection algorithms. Her skills include ANI, quantum physics, critical thinking, and mathematics.

Quantum transmission through a self-similar two-dimensional structure

My aim in this thesis was to obtain results for quantum transmission and reflection through the Cayley tree structure. The scope of this project was to obtain transmission through a 2-layer and 3-layer Cayley tree structure within before the end of May 2023. Here, I used MATLAB for mathematical calculations using numerical analysis. Here, I fed in random scattering matrices to each of the nodes for the 3-layer Cayley tree structure with an input into node A from the left set to 1. Then using the inputs and scattering matrices, I obtained the reflection and transmission wave amplitudes for nodes A, D, E, F and G. The equation used for calculations was □out = S*□in for each of the node's A-G. Figure 1 shows the histogram I obtained for my results when using a regular 3-layer Cayley tree structure with the same scattering matrix fed into each of the node's A-G. Figure 1 also show the Cayley tree structure used with nodes A-G. In the structure, there are three branches for each node with three input and out wave amplitudes for each nodes A-G. Here, it can be seen that the transmission wave amplitudes for node's D-G are equal whilst the reflection wave amplitude for node A is much greater than each of the individual transmission wave amplitudes for nodes D-G. Overall, when changing the scattering matrices across the nodes in the structure, the transmission and reflection wave amplitudes also varied where I tested other Cayley tree structures such as irregular and asymmetric Cayley tree structures. Further tests can be done on a 3-dimensional, 3-layered Cayley tree structure. .

Hans Kosina
Vienna University of Technology, Austria

Biography

Hans Kosina received the PhD degree in technical sciences and the venia docendi in microelectronics from the Vienna University of Technology, where he is currently employed as a professor at the Institute for Microelectronics. His research interests include Technology CAD, semiconductor device modeling, electronic transport in nanostructures, Monte Carlo methods for classical and quantum transport, modeling of carbon nanotube and graphene-based devices, nanostructured thermoelectric energy converters, and optoelectronic devices. Kosina is Associate Editor of the Journal of Computational Electronics. He authored and co-authored more than 180 publications in peer-reviewed journals and 500 contributions to conference proceedings.

Modeling of Electron-electron Scattering Nanoelectronic Devices

Electron-electron scattering (EES) affects the shape of the energy distribution function of charge carriers. This effect has to be considered, for instance, in the modeling of hot carrier solar cells, or in the physics-based modeling of hot carrier degradation of semiconductor devices. The widely used Boltzmann transport equation becomes nonlinear if EES is included in the scattering operator. Traditionally, the numerical solution of that nonlinear equation requires additional approximations and comes at high computational cost. In this work we resort to a two-particle formulation. The kinetic equation for the two-particle distribution function is linear and can be solved by Monte Carlo (MC) methods. While deterministic methods suffer from the curse of high dimensionality, the efficiency of the MC method degrades only little when the dimension of the underlying phase space is increased.

For the solution of the stationary transport problem a two-particle MC algorithm has been developed. In stationary simulations of bulk silicon no visible effect of EES on the distribution function and consequently on the electron mobility is observed. In stationary device simulations, however, EES causes an enhanced high energy tail relative to the thermal tail. Currently, methods for statistical enhancement at high energies are under development. The transient transport problem is addressed by an ensemble MC algorithm. The mean energy of hot carriers is observed to relax faster in the presence of EES, whereas the cold carriers experience a temporary energy increase.

Chulin Jiang
Teesside University, UK

Biography

Chulin Jiang is a lecturer in Teesside University, UK. Before this role, she worked at University of Portsmouth on an Interreg FLOWER project (Flax composites, LOW weight, End of life and Recycling) and Interreg Sea Bio Comp. This research was mainly about the development of sustainable lightweight composites and bio composites.

Her main research interest is the development of sustainable bio-based lightweight composite materials and hybrid composites, investigating their mechanical, thermal and environmental properties for engineering applications. She is a co-investigator of the Innovate UK project High Performance, High Power, Partial Discharge Resistant Wire Insulation (10034049 HP2_PD-WIN)

Preparation and Characterisation of Polyethylene/ Porous filler Composites as Potential Low Insulation Materials

Electrification across transportation sectors represents a major pathway towards net zero destination. This signifies demands on high performance electrical machines where higher working voltage and temperature are frequently needed. Such requirements place great challenges on electrical insulations because insulators deteriorate fast at high temperature and failure through partial discharge (PD) increases when voltage increases. Improvement of PD performance of electrical insulation has become a key research area, this is particularly important for electric aircraft because PD becomes more serious at high altitude.

PD phenomenon is omnipresent in electric insulation and is influenced by many factors such as applied voltage, type of insulating material, void size, and shape etc. This paper presents a new approach to improve PD performance of electric insulation through enhancing materials' PD resistance and increasing PD inception voltage, using polyethylene/Porous filler as a demonstrator. The incorporation of Porous filler plays dual functions: (i) introducing air to reduce dielectric constant of the insulation and thus increase the PD inception voltage; and (ii) increasing PD resistance as porous filler is more stable than polymer under PD scenario, reducing carbonation of polymer. In this study, a multivariable design of experiment via Taguchi method has been conducted to investigates the influence of various compositional and operational parameters on the electrical, thermal, chemical and mechanical behaviours of this polyethylene/ Porous filler composites with a view to determine significant variables and to find optimal combination. Experimental results confirm that the decrement of dielectric constant is achievable while retaining good mechanical strength and thermal conductivity.

Bekalu Tesfaye
Addis Ababa University, Ethiopia

Biography

Bekalu Tesfaye is a Structural designer of complex multipurpose buildings; private and governmental, concrete, and steel framed structures. Structural analysis and design of concrete framed, steel framed high rise buildings using software (SAP2000, ETABS, SAFE). research on intelligent energy systems, aerospace structures, innovative mechanical system analysis and design (which may involve extensive utilization of FE software ANSYS, SolidWorks)

Single Cell Ionization using Laser Trapping Technique and Its Possible Biomedical Application

In this thesis, we have conducted a study to have a closer understanding of human red blood cells (RBCs) when they are interacting to a laser trap formed by a highly focused laser beam. We focused on the effect of the laser field to the dielectric living cell that could lead to ionization of the cell during, and after trapping that we have studied in three phases: pre-ionization, ionization and post-ionization phases.

During the first phase of ionization, cells of varying size are subjected to a 1064 nm infrared radiation one by one and their trajectory (radial and tangential) towards the center of the trap have been recorded and analysed. In our analyses we used a theoretical model that we developed for pre-ionization that assumes of the existence of charge that resulted from the interaction of the RBCs with the radiation field of the laser. The result showed that the cells indeed gain some charge even before being trapped, i.e., while they are on their way to the center. As a result, the charged cells have been observed interacting with the electromagnetic field creating a Coulomb force in the direction of polarization. In effect, the developed charge significantly affected each cell's trajectory towards the trap center. This has been proved by observing the relative acceleration of those cells located where the gradient force vector and direction of polarization are in opposite direction with respect to those cells located where the two vectors line up. Lower acceleration has been observed for the former case than the latter.

Using the model developed by other research that describes the post-ionization phase of the cells, we have also calculated the charge developed on each cell and have made comparison with the pre-ionization phase. The results showed that the charge on the cell for post-ionization is bigger than pre-ionization as one should expect.

Zhongyuan Xing
Teesside University, UK

Biography

Zhongyuan Xing is a PhD student in the School of Computing, Engineering and Digital Technologies at Teesside University, studying in metal and ceramic composites. She is also a part time research assistant and has participated several projects funded by UK research councils and industries, e.g., the Innovate UK project (10034049 HP2_PD-WIN) which developing partial discharge resistant insulations for aerospace application. Her research interest is mainly in the structure and properties of metal and ceramic composites. She is keen on exploring novel material processing methods and finding innovative solutions for material performance enhancement and accumulated rich experience in carrying out research project

Optimisation of bioactivity and mechanical properties of zirconia/hydroxyapatite composites for dental implant

Zirconia is an excellent material and widely used for dental implant crowns due to its outstanding mechanical properties and natural appearance. However, zirconia has poor adhesion to gum tissue which may leave a connection gap between the implanted crown and the natural gums, where bacteria are likely colonised. This study aims to enhance the bioactivity of zirconia to improve its adhesion to the gums in implant crown applications, addressing the issue of potential microbial colonization in between the zirconia crown and gums. Hydroxyapatite was chosen as a modifier to achieve the objective, owing to its significant presence in natural bone and exceptional biological activity. In this study, a series of zirconium oxide/hydroxyapatite composites were prepared with different compositions and processing conditions in order to obtain the most suitable composite for the intended application. The resulting composites were fully characterized using a range of analytical techniques and mechanical testing methods to determine the structure-property relationship of the composite. Experimental results indicate that the properties of composite materials are significantly influenced by the component ratio and sintering temperature. Increasing the hydroxyapatite component in the composite enhances biological activity but at the meantime reduces mechanical properties. The composite containing 10% hydroxyapatite exhibits excellent biological activity while maintaining sufficient mechanical strength. The optimal sintering conditions are found to be at 1400°C for 2 hours for this composite system, while lower temperature cannot achieve fully sintering and higher temperature convert zirconia to different crystalline structure, both are not good for mechanical properties.

Waqas Yousaf
Quaid-I-Azam University, Pakistan

Biography

Waqas Yousaf is an Atomic and Molecular Physicist. His research interest are Laser Spectroscopy, Optics and Photonics. He has completed his Master of Philosophy in Physics (18 years) from the No. 1 university in Pakistan Quaid-I-Azam University, (QS world rank: 454)). Moreover, he is also a CLPU (The Centre for Pulsed Laser-Spain) granted researcher.

Measurement of photo ionization cross- section of auto ionizing states of Xenon by using opt galvanic spectroscopy

The work in my presentation explains the experimental study of measuring the photoionization cross section of autoionizing resonances of xenon. We have analysed the peak of the autoionization resonances of the 5p5nd [3/2]2, 5p5nd [5/2]2,3 (7? n? 10) by using opt galvanic technique in conjugation with the tuneable dye laser system pumped with Nd: YAG laser. A xenon filled see-through hollow cathode lamp operated at ~ 5mA was used for the glow discharge. The metastable state 5p5(2P3/2)6s [3/2]2 populated in the discharge was used to excited three different states; 5p5 6p[1/2]1, 5p56p[3/2]1, 2. These states serve as an intermediate levels to further excite into the autoionizing resonances. According to the jlK coupling scheme transition rules, all allowed transitions were recorded for 7? n? 10. These resonances were recorded by scanning the laser wavelength across the profile. We observed broad resonances showing strong coupling with the adjacent continuum. We also measured the photoionization cross section at these dominant autoionization peaks using the saturation technique. At the peaks of the autoionization resonances, the absolute values of the photoionization cross section above the first ionization threshold were found to be 189.2± 28.3Mb , 198.9 ± 29.8Mb for n=7 at wavelengths 726.2nm and 716.2nm, 208 ±31 Mb, 145 ± 21.7Mb for n=8 at wavelengths 644.3nm and 637.3nm, 86.8±13 Mb, 81.5± 12.5Mb, 77.4±12 Mb for n=9 at wavelengths 574.2nm, 600.1nm and 605.1nm, 101.7±15.5 Mb, 101.7 ±15.5 Mb, 93.8 ±14 Mb, 89±13 Mb for n = 10 at wavelengths 553.9nm, 578.3nm and 582.6 nm respectively.

Eslam A. Mohamed
Egyptian Petroleum Research Institute, Egypt

Biography

Eslam A. Mohamed is an Associate professor of Applied Physical Chemistry at Petroleum Applications Department, Egyptian Petroleum Research Institute (EPRI), Nasr City, Cairo, Egypt. Postal code: 11727, Nasr City, Cairo, and Lecturer in the faculty of Science, Mansoura University. He received his master's degree in organic chemistry from Zagazig University and Ph.D. degree in organic chemistry from Ain Shams University.

Challenges, opportunities, and innovative technologies for biofuel production and sustainable environmental management

Currently, the most commonly used fossil fuels account for more than 95% of the world's major energy consumption. However, because of their increasing price all over the world, which decreased the progress of development in the developing countries. Consequently, the investigators were focused to reduction the necessity on the rock-fuel by accessible, low-priced and economic alternate energy sources. Additionally, the universal heating and the upsurge of the earth's temperature is considered a universal problematic. That is because of the increase of CO2, CO, SOx, and NOx discharged from developing activities and automobile appliances. The two objectives of this study are to replace rock-fuel with alternate ecologically approachable, renewable and economic sources of energies for developing activities and automobile appliances; also to reduction of released warming and corrosive gases in the atmosphere so as to lessen the green-house gases (GHG).The projected approach is preparation of biofuels from renewable resources, mainly waste cooking oils (WCO). The targeted liquid fuels are biodiesel, bio-gasoline and biojet using economic, conventional and simple methods. Two main conventional methods will be established which are transesterification and catalytic cracking processes using novel and efficient heterogeneous catalysts. The catalysts will be basic and acidic heterogeneous in nature. The synthetic role of the catalysts depends on the economically and low-cost raw materials from the Egyptian resources. The targeted heterogeneous catalysts in the study are modified Nano graphene oxide, nano-layered double hydroxide (LDH), modified diatomite and acidified mica clays. The study will expand to explore the synergistic effects of the different metals presented in the framework of the targeted nano-catalysts. In addition, the different types of the produced biofuels will be characterized, analyzed and evaluated for their fuel properties in engines and their economic blends by the petroleum fuel. The expected outcomes of the study are the following: firstly, producing different biofuel grades for different types of engines and power stations; secondly, replacement the petroleum fuel by 25% of the biofuel to decrease the cost and GHG to about 50%. Finally, preparation of efficient heterogeneous catalysts for different catalytic cracking processes instead of the imported catalysts, and diverse heterogeneous nano-catalysts for biofuels fabrication processes. Potential economic impact: the economic impact of the study is expected to save more than 25% of the importing costs of the crude oil with decreasing the emitted GHG to more than 50% and setup a semi-pilot unit for biofuel production in order to commercialize the process.

Zhonghuan Zhang
Universitat Rovira i Virgili, Spain

Electron-phonon Coupling Laser Crystal Research

Traditional lasers rely on fixed electronic energy level transitions, which constrain their emission wavelengths. This research investigates electron-phonon coupling, where lattice vibrations (phonons) enable electron transitions beyond intrinsic limitations. We developed a theoretical model that incorporates multi-phonon stimulated emission, opening the possibility for customizable laser wavelengths. The model guided the design of a novel laser system. We identified key material properties for strong electron-phonon coupling, including high charge density, short bond lengths, and effective superposition. This led us to select a ReCOB system doped with ytterbium ions. We successfully demonstrated laser output in the “dark region” of the spectrum, achieving emission wavelengths beyond the typical fluorescence range. It paves the way for wavelength extension lasers with potential applications across various fields.

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POSTERS
Day 1

Athar Mahdieh
University of Oslo, Norway

Biography

She is highly dedicated individual currently pursuing a PhD in pharmaceutics at the University of Oslo, Oslo, Norway. I have gained invaluable experience working on research projects under esteemed professors, expanding my expertise and contributing to the academic community. Her research focuses on the preparation and characterization of novel polymeric nanocarriers for cancer drug delivery. We seek to broaden our perspective and foster collaborative opportunities to further our research endeavors.

Design of novel polyurethane-based ionene nanocarriers for cancer therapy: Synthesis, in-vitro, and in-vivo studies

New strategies for constructing versatile nanocarriers are needed for cancer therapy to overcome the multiple challenges of targeted delivery. This work explores the advantages of polyurethane with main-chain quaternary ammonium salt moieties (ionene) as a novel carrier for targeted drug delivery. We have developed a novel cationic soybean oil-based polyurethane ionene nanocarrier (CPUI) that can act as an effective anticancer agent and efficiently deliver the 5-fluorouracil (5FU) anticancer drug. We also report a potential anticancer drug delivery system targeting the folate receptor. In vitro experiments with blank CPUI carriers on the 4T1 (mouse breast cancer cell line) and the NIH-3T3 (mouse fibroblast cell line) revealed high cytotoxicity for the cancer cells but only low cytotoxicity for the normal fibroblast cells. The CPUI nanoparticles were readily loaded with 5FU in water using electrostatic interactions between the cationic quaternary ammonium groups of ionene and the anionic 5FU. The in vivo study in mice with tumors showed that the blank CPUI carriers significantly inhibited tumor growth, even more than the free drug. Further enhancement of the inhibitory effect was observed when folic acid was added as a targeting moiety to the system via ion exchange with the bromine counterion of the quaternary ammonium moieties. The results suggest that the efficacy of FA-CPUI-5FU nanoparticles as vehicles for drug delivery can be enhanced via folate receptor-mediated endocytosis in 4T1 cells and these novel nanocarriers may provide a potential platform for effective targeted drug delivery to tumor tissue and breast cancer therapy in the clinic.

Lucia Tormo
University of Barcelona, Spain

Sources of Classicality in Linear Optics: A Diagrammatic Perspective

Linear optics is a model of quantum computation based on photon interference. It can be used to perform universal computation as Knill, Laflamme, and Milburn presented in a paper in 2001, although it had some limitations. Since then, linear optics as a restricted model of quantum computation remains mathematically hard to approximate classically. Recently, a new model has been proposed as a basis for constructing a photonicfault- tolerant quantum computer. In this new model, photon losses are the primary considered source of error. Nevertheless, a model that accounts for errors due to photon distinguishability is yet to be found. A graphical language is a construction with an internal structure alternative to mathematical formulations. It consists of a series of generators and axioms that we will use to reason about physical processes diagrammatically and unambiguously. In the present work, we have extended the graphical calculus of to formalise density matrices in the context of linear optics and prove the results of on photon losses graphically. In addition, this graphical framework encompasses and formalises photon distinguishability and could prove itself to be a useful avenue to future work in the direction of quantum error correction, unfortunately, it is out of the scope of this project. Often, computations are expressed in either cumbersome, hard mathematical language or through diagrams that do not capture well enough the computational process to enable us to reason about it graphically. We will model linear optical circuits diagrammatically through QPath (a recent graphical calculus), which will help us simplify them. We will explore how this graphical approach helps us calculate probability amplitudes.

Yan Zhao
Institute of Optics and Electronics, Chinese Academy of Sciences, China

Single-frame interference phase retrieval method based on virtual phase shift

Multi-step phase shift method is a mainstream demodulation method for phase retrieval; however, time and environment errors significantly impact measurement accuracy. In this study, we propose a single-frame interference phase retrieval method based on virtual phase shift. The multi-stage architecture for progressive image restoration is applied to build a phase-shift generator (PS-G). This PS-G generates three interferograms with specific phase shifts from interferograms recorded in a single frame excellently. The phase can be retrieved using generated phase-shift interferograms. Further. By analyzing different types of aberrations, RMS value of error map retrieved by the proposed method is less than . All the results show that our solution is available for the problem of single-frame phase measurement and has excellent generalization ability. The proposed method emerges as a novel alternative approach to high-accuracy dynamic phase measurements.

Kais Iben Nassar
University of Aveiro, Portugal

Comprehensive Characterization of (Bi0.5Ba0.5Ag) 0.5(NiMn) 0.5O3 Perovskite Ceramic: Structural, Dielectric, and Electrical Insights

The perovskite ceramic (Bi0.5Ba0.5Ag) 0.5 (NiMn) 0.5O3, a member of the manganite family, stands as a pivotal material for diverse technological applications. Synthesized through the sol-gel technique, this study delves into its structural, morphological, dielectric, and electrical properties. Rietveld-refined XRD analysis confirms its orthorhombic structure, laying the groundwork for further investigation. Dielectric studies unveil the presence of Maxwell-Wagner-type dispersion, indicative of charge accumulation along grain boundaries and interfaces. Complex impedance and electric modulus analyses unravel microscopic dielectric relaxation intricacies and the material's conduction mechanisms. Notably, electric modulus spectroscopy uncovers non-Debye-type relaxation encompassing both localized and long-range processes. Nyquist plots corroborate the ceramic's semiconducting behavior, offering valuable insights into its electrical nature. Application of the Arrhenius law to the imaginary part of electrical impedance and conductivity yields activation energies and relaxation times, enriching our understanding of its electrical properties. This comprehensive scrutiny not only sheds light on the intrinsic characteristics of the ceramic but also highlights its potential applications, paving the way for diverse device implementations.

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KEYNOTE SPEAKERS
Day 2

Wanyang Dai
Nanjing University, China

Biography

Wanyang Dai is a Distinguished Professor in Nanjing University, Chief Scientist in Su Xia Control Technology. He is the current President & CEO of U.S. based (Blockchain & Quantum-Computing) SIR Forum (Industrial 6.0 Forum), President of Jiangsu Probability & Statistical Society, Chairman of Jiangsu Big Data-Blockchain and Smart Information Special Committee. He received his Ph.D. in mathematics and systems & industrial engineering from Georgia Institute of Technology in USA. He was a MTS and principal investigator in U.S. based AT&T Bell Labs (currently Nokia Bell Labs) with some project won "Technology Transfer" now called cloud system. He was the Chief Scientist in Depth Data Digital Economic Research Institute. He published numerous influential papers in big name journals including Quantum Information Processing, Operations Research, Operational Research, Queueing Systems, Computers & Mathematics with Applications, Communications in Mathematical Sciences, and Journal of Computational and Applied Mathematics

Quantum entanglements and operations for programmable quantum computers

We study quantum entanglements and operations for programmable quantum computers through deriving a general spherical coordinate formula for a quantum state of n-qubit register. The associated angle-based n-qubit operation rules on a (n+1)-manifold are established to help developing (cold atom, photon or other techniques based) programmable quantum computers, which are simple and efficient in the sense that they reduce the complicated quantum multiplication and division operations to simple addition and subtraction operations just like those used in a conventional computer. The rules for n-qubit operations are realized through measurement-based feedback controls and quantum entanglements to develop scalable quantum computer chips and implement quantum-cloud computing. The performance models are also derived through the scaling limits (called reflecting Gaussian random fields on a manifold) for n-qubit quantum computer-based quantum storage systems.

Chinmoy Bhattacharya
Apc Private Ltd, India

Biography

Chinmoy Bhattacharya is a PhD in Polymer Physics from India in the year 1988. He then did his post-doctoral studies on Polymer physics of liquid crystals and is back to India in the year 1991; he joined paint Industry ICI INDIA LTD. He continued his research work on quantum gravity and theory of relativity and has recently come up with an altogether new unified quantum gravity theory. He has about 12 publications in Polymer national /international journals and his work on Cosmology, Theory Quantum gravity Dark Matter. He is a renowned person in India in the Field of Paints. He has had his own paint Industry in India and was the ex-chairman of IPA, the Indian Paint Association. He has invented a new initiator for free radical polymerization too and that work is published in UK journal (Royal Society of Chemistry, Polymer Chemistry, and DOI: 10.1039/COPY00180E). He is a guest faculty of the university of Calcutta and teaching Colour Physics, Polymer and dispersion physics and rheology of coatings to the Master students.

The Newly Discovered Topological Theory of Quantum Gravity (Ttqg) - A Multiblock Compatibilizer Cum Modifier of The Existing Theories of Physics, Cosmology, Quantum Mechanics, and Quantum Computing

The recently discovered topological theory of quantum gravity (TTQG) is projected as a multi block theory having a core central block with multiple sub blocks grafted on the central block. Emerged out from the said central block, the sub blocks are spread all around multiple corners and they are connecting TTQG to most of the principal theories of physics and cosmology. While all the new concepts of TTQG are embedded in the core central block, the sub blocks truly play the role of 'compatibilizer'. In this article it has been shown straight forward that each sub block is compatibilizing one or the other streams like, e.g., quantum mechanics, the relativity theories, thermodynamics, cosmology, quantum computing. Etc…and the others. Also, an altogether new 'spatial and topological interpretation of Quantum mechanics' have been given regarding the operability of 'quantum mechanical operators' on the wave function?

Most of the principal theories of physics and cosmology are 'non-topological' and suffer from the serious problem of 'formlessness or shapelessness of the physical variables of the universe'. In this research article it has been demonstrated that the TTQG apart from its 'compatibilizer' action on the other theories of physical science, also acts as a modifier of the said theories through its following inherent broad frame logic and philosophies.

Osman Adiguzel
Firat University, Turkey

Biography

Adiguzel graduated from Department of Physics, Ankara University, Turkey in 1974 and received PhD-degree from Dicle University, Diyarbakir-Turkey. He has studied at Surrey University, Guildford, UK, as a post-doctoral research scientist in 1986-1987, and studies were focused on shape memory effect in shape memory alloys. His academic life started following graduation by attending an assistant to Dicle University in January 1975. He became professor in 1996 at Firat University in Turkey, and retired on November 28, 2019, due to the age limit of 67, following academic life of 45 years.

Shape Reversibility and Diffraction Studies in Copper Based Shape Memory Alloys

Shape memory alloys take place in a class of advanced structural materials by exhibiting dual memory characteristics, shape memory effect and superelasticity with the recoverability of two shapes at different conditions. Shape memory effect is initiated with thermomechanical processes on cooling and deformation and performed thermally on heating and cooling, with which shape of the material cycles between original and deformed shapes in reversible way, and this behavior can be called thermoelasticity. This phenomenon is governed by the crystallographic transformations, thermal and stress induced martensitic transformations. Thermal induced martensitic transformation occurs on cooling with cooperative movement of atoms in <110 > -type directions on {110} - type plane of austenite matrix, along with lattice twinning and ordered parent phase structures turn into the twinned martensite structures, and twinned structures turn into detwinned martensite structures by means of stress induced martensitic transformations with deformation. Superelasticity is performed in only mechanical manner with stressing and releasing the material in elasticity limit at a constant temperature in the parent austenite phase region, and shape recovery occurs immediately upon releasing, by exhibiting elastic material behavior. Superelasticity is performed in non-linear way, unlike normal elastic materials behavior, loading and releasing paths are different at the stress-strain diagram, and cycling loop refers to the energy dissipation. Superelasticity is also result of stress induced martensitic transformation, and the ordered parent phase structures turn into the detwinned martensite structures with stressing. It is important that lattice twinning and detwinning reactions play important role in martensitic transformations. Copper based alloys exhibit this property in metastable β-phase region, which has bcc-based structures. Lattice twinning is not uniform in these alloys, and the ordered parent phase structures undergo the non-conventional layered structures with martensitic transformation. These layered structures can be described by different unit cells as 3R, 9R or 18R depending on the stacking sequences on the close-packed planes of the ordered lattice. In the present contribution, x-ray diffraction and electron diffraction studies were carried out on copper-based CuZnAl and CuAlMn alloys. X-ray diffraction profiles and electron diffraction patterns exhibit super lattice reflections. Critical transformation temperatures of these alloys are over the room temperature, and the specimens were aged at room temperature, and a series of x-ray diffractograms were taken during aging. X-ray diffractograms taken in a long-time interval show that locations and intensities of diffraction peaks change with the aging time at room temperature, and this result refers to the redistribution of atoms in diffusive manner.

Masayuki Itoh
Tokyo University of Technology, Japan

Biography

Masayuki Itoh is a professor at the school of health sciences, Tokyo University of Technology. He received the Ph. D. degree in electrical and electronic engineering from the University of Tokyo, Japan. He has worked at Nippon Telegraph and Telephone co. (NTT) as a research scientist in the Basic Research Laboratories. Since 1995, he has engaged in the research on integrated devices using lasers, semiconductor optical amplifiers (SOAs) and silica-based planar lightwave circuits (PLCs). Especially, he successfully fabricated silica-based waveguides with an extremely high-Δ and a low propagation loss. Since 2014, he moved to Tokyo University of Technology and has been engaged in the research on medical electronics, biological information engineering.

Fabrication of waveguides with high optical confinement and application to future high-capacity networks

The fabrication process of waveguides with high optical confinement for high-speed, large-capacity transmission, the current status of optical networks applying these waveguides, handling and transmission methods of healthcare data (physical and mental) in the future high-speed data society, and the measurement and evaluation of these data will be reviewed. In realizing high-speed and high-capacity transmission, silica-based planar lightwave circuits (PLCs) are key devices for optical communication networks based on optical transmission systems, such as metropolitan networks and access networks, as well as for backbone applications. PLC devices, especially silica-based arrayed waveguide gratings (AWGs) for wavelength division and wavelength division, power splitters for splitting optical signals, and optical switches for switching circuits, play an important role in practical transmission systems. In these systems, PLC devices are expected to be single-chip, compact, and highly integrated to reduce manufacturing costs and increase the number of channels. To realize these goals, it is very important to miniaturize devices such as AWGs. For example, even if the refractive index difference Δ of a waveguide is 2.5 %, a bent waveguide with a curvature radius as large as 1 mm occupies a large area in the package. Therefore, it is not possible to increase the mounting density of the device. One way to overcome this problem is to use extremely high-Δ (>2.5%) waveguides that can be bent compactly.The presentation will focus on the fabrication process of these extremely high-Δ waveguides, followed by a discussion of the current state of optical networks and the transmission and evaluation methods for physical and mental health care data, especially biological information data [3], in the future high-speed, large-capacity data society.

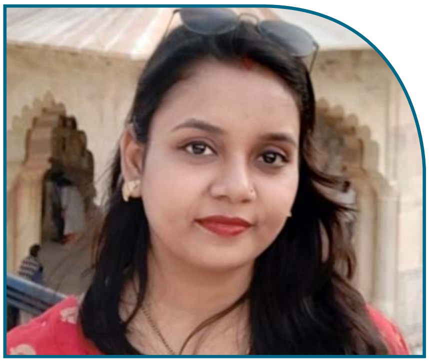
Aneliya Kostadinova
Institute of Biophysics and Biomedical Engineering, Bulgaria

Biography

Anelia Kostadinova currently holds the position of Associate Professor in the "Lipid-Protein Interactions" Section at the Institute of Biophysics and Biomedical Engineering at the Bulgarian Academy of Sciences (BAS). Her scientific interests into establishing the interaction of different types of cell lines with synthetic or natural material, as well as nanoscale materials (nanoparticles) for application in modern biomedicine:The evaluation of the biocompatibility and applicability of these biomaterials is carried out by considering cytotoxicity and following changes in the adhesive phenotype of cells, cell contacts and especially changes in the cell boundary complex, the first structure with which materials interact. The contribution nature of the research is fundamental – establishing the mechanisms of the changes in the cell membrane by means of different signaling molecules and pathways that have an impact on the cell border complex and cell physiology.

Newly synthesized second-generation dendrimers on human fibroblasts and the mechanism of their cellular uptake

In recent years, dendrimers and their derivatives have attracted significant attention in contemporary nanotechnology due to their potential use in biomedicine. Dendrimers are polymeric nanoparticles with a highly branched structure emanating from a common center. First-generation polypropyleneamine dendrimers can undergo peripheral modifications, resulting in two new photoactive dendrimers containing 4-dimethylamino- 1,8-naphthalimide 9 (DAB) and 3-bromo-4-dimethylamino- 1,8-naphthalimide (DAB-Br), referred as second-generation of dendrimers. The current study examines the cytotoxic potential of new second-generation dendrimers, Dab and Dab-Br, on eukaryotic cell fibroblasts from the HFS line. Furthermore, the study provides a comprehensive elucidation of the mechanism of their cellular uptake. Chemical synthesis protocols yielded stable second-generation dendrimers with cationic nature and size ranging from 119 to 267 nm. The cytotoxicity evaluation was carried out by MTT analysis, revealing a clear concentration-dependent cytotoxicity. DAB exhibited two times higher activity in comparison to Dab-Br. Microscopic techniques were utilized to reveal the mechanism of their cellular uptake. The results showed that both dendrimers led to rapid and maximum membrane permeabilization at the highest tested concentrations. Furthermore, dendrimers showed high internalization in the cells around the cell nucleus, accompanied by time-dependent cell morphology alternations. Lastly, Laurdan fluorescent spectroscopy was employed to measure quantitative changes in membrane organization upon treatment with the dendrimers. The results revealed that dendrimers led to significant membrane fluidization at the highest concentrations, facilitating its subsequent permeabilization. The findings in this study are promising for future potential applications of the newly synthesized dendrimers, from forming stable surfaces` coatings and bandages to instruments in medical practice.



Kirti Sharma
Birla Institute of Technology, India

Biography

Kirti Sharma, a research scholar of Physics Department at Birla Institute of Technology, Mesra, Ranchi. She is working under guidance Dr Pawan K. Tiwari. She has completed her BSc. (PMC) from Harishchandra PG College, Varanasi. She has completed her MSc. Physics from Harishchandra PG College, Varanasi. And Now She is pursuing Ph.D. from Birla Institute of Technology, Mesra, Ranchi.

Machine Learning: A crucial tool in the characterization of Quantum Dots

Quantum dots (QDs), nanoscale particles, have garnered significant attention for their unique optical and electronic properties, making them pivotal in various technological applications. As the complexity of QD systems grows, there arises a pressing need for advanced characterization techniques to unravel their intricate behaviours. Machine learning (ML) has emerged as an indispensable tool in this context, offering a powerful and efficient means to analyse and interpret the vast amounts of data generated during the characterization process. We explore the challenges associated with traditional characterization methods, such as the limitations imposed by instrumentation precision and the overwhelming data generated from experiments. Machine learning algorithms, ranging from supervised to unsupervised techniques, effectively extract meaningful patterns, correlations, and insights from this data. Supervised machine learning models, including regression and classification algorithms, play a crucial role in predicting quantum dot properties based on training datasets. These models enable the identification of relationships between input parameters and specific characteristics of quantum dots, facilitating the prediction of behaviour in novel QD systems. Unsupervised learning techniques, such as clustering and dimensionality reduction, aid in uncovering hidden structures within datasets, providing a deeper understanding of the intricate nature of quantum dots. Furthermore, ML-driven techniques enhance the efficiency of experimental design, optimizing parameters for QD synthesis and characterization. Adaptive algorithms can iteratively refine experimental conditions based on real-time feedback, accelerating the discovery of desired quantum dot properties. The symbiotic relationship between machine learning and quantum dot research, emphasizes the pivotal role of ML in advancing our understanding and utilization of these nanoscale semiconductor structures in various technological applications.

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

Biography

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

Liquid Crystal Photoalignment by Azodye Nanolayers: New Liquid Crystal Photonics Devices

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

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

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SPEAKERS
Day 2

Maria Meirelles
University of the Azores, Portugal

Biography

Maria Gabriela Meirelles has a Diploma in Physics from the State University of Rio de Janeiro, Brazil in 1992, a Geophysics Master in the field of Meteorology from University of Lisbon (Faculty of Sciences), Portugal in 1997 and got her PhD in Physics from the Azores University (UAC), Portugal in 2009, in the field of Geophysical Sciences. Her teaching activities include topics on meteorology/atmosphere/climatology, general physics, physics for biology and geophysics, among others, for undergraduate and master studies. She has participated in several scientific conferences, and she has published several research articles and book chapters.

Gamma Radiation: Implications for Respiratory Health _ Azores

To monitor radioactivity in the environment, the Network for Continuous Surveillance of Radioactivity in the Environment (RADNET) was created, which can detect situations of abnormal increase in radioactivity. RADNET has a fixed station in Ponta Delgada, whose data were used in this study. Regarding the annual average values of the dose rate of gamma radiation in the environment, the data collected between 2010 and 2020 at the Ponta Delgada station correspond to values of the natural radioactive background of the place where the measurement took place. Diseases of the respiratory system are responsible for many deaths per year. The objective of statistical inference was to allow the researcher to draw conclusions about a population from a sample, which is representative of the population under study. The correlation between radiation levels and the value of the monthly averages of respiratory pathologies is statistically significant, positive, and moderate ($r = 0.486$, $p < 0.001$). Thus, as environmental levels of gamma radiation increase, also the number of patients with respiratory pathologies increase.

Arnaud Caron

KoreaTech - Korea University of Technology and Education, South Korea

Biography

Arnaud Caron is a materials scientist with expertise in the multi-scale mechanical behavior of materials, surfaces, and micro-components. Since 2015 Arnaud Caron has been a faculty member at Korea Tech – Korea University of Technology and Education, Republic of Korea. Arnaud Caron obtained his engineering degree in Materials Science in 2004 from the University of Saarland, Germany. In 2009, he earned his doctoral degree in Materials Science from the University of Saarland, Germany. From 2007 to 2015, Arnaud Caron worked as a research associate at the Institute of Micro- and Nanomaterials of the University of Ulm, Germany, the WPI-Advanced Institute of Materials Research at the Tohoku University, Japan, and the Leibniz – Institute for New Materials, Germany.

Friction and wear at the nanometer scale: Identification and control of the governing mechanisms

Friction and wear significantly impact societies, economies, and the environment. Friction losses alone amount to a fifth of global energy production. This figure is even more severe if wear and its related costs for parts replacement, materials production, and resource depletion are considered.

Interactions between materials in sliding contacts are complex and involve structural and chemical effects. Contacts between material surfaces initiate at nanoscopic asperities that can be experimentally realized under controlled conditions by applying atomic force microscopy as a nano tribometer.

This lecture overviews recent experimental results on the friction and wear of various materials at the nanometer scale, such as elastomer, metal, and silicon surfaces. These results illustrate the diversity of operating mechanisms and how they can be selectively investigated.

Derrek S Luke
University at Albany, USA

Biography

Derrek Luke is a Bachelor of Arts graduate from the School of Information Science at the University at Albany and holds vocational certifications in IT and Business Administration.

The Innovation Pool: A New Model for Open Innovation

This E-poster visualizes the concept of open innovation by introducing the Innovation Pool, a model that encourages collaboration and knowledge sharing among organizations to accelerate innovation in a rapidly changing and interconnected world. The key elements of the Innovation Pool are digital communication and networking that include a collaboration platform, a community of experts, and a guided innovation process. The Innovation Pool emphasizes the need for organizations to prioritize readiness and engagement to respond to disruptive technological advancements. This process ensures that collaborative efforts lead to tangible results of the innovation process from ideation to implementation. It also highlights the value of autonomy and scalability in fostering innovation. This model portrays a comprehensive framework for organizations to tap into a broader range of collective knowledge and expertise, ultimately driving open innovation, growth, and success in the modern era.

Hans Deyssenroth
Individual Researcher, Germany

Biography

Hans Deyssenroth (Germany/Switzerland) received several awards in jazz- and computer music-competitions. He performed with many jazz artists and e.g. with the Oscar Klein Group and the Space Rock group Brainticket among others. At present he is also playing with the groups Salamuja and Hornflakes. He has developed a computer program midi VAR which enables a musician to experimentally vary the midi parameters and generate variations. In 1982 he presented it at the ars electronica as the first improvising computer. Some years ago, he started to experiment with afrocuban and african rhythms in jazz

Surprises in the Lunar-Laser-Ranging-Data

What happens to a laser beam that points from the bottom of a train (at rest) to a point in the ceiling when the train is moving very fast? Will the beam still hit this point, or will it hit the ceiling behind this point? In the years around 1900 scientists were convinced that photons get a lateral momentum in the direction of movement, because they are particles. But R. Feynman concluded that a mirror emits new photons and is therefore a light source and together with Einstein's second postulate of the STR the laser beam should hit the ceiling behind this point. This can be tested with the return rates of photons from a mirror on the moon. The results show clearly with an error of probability <10-80 that photons do not get a lateral momentum but arrive at that location where the earth was 2.55 seconds before. Besides the detection of an additional velocity of earth in the universe this article proves that Einstein's geometric space-time idea is wrong because the physical basis for that is wrong.

Omkar Charapale
Deakin University, Australia

Biography

Omkar ia an aspiring Mathematical Chemist, and PhD candidate at the Institute for Frontier Materials (IFM), Deakin University, Melbourne, Australia. He was Graduated from the Indian Institute of Science Education and Research (IISER), Mohali, India with a master's in chemistry and a physics minor. He is Highly interested in mathematical modelling based on general theories (like Quantum Mechanics, Continuum theory) to relate and solve Complex Chemical problems connected to Symmetry(Spatial, Dynamical), degeneracy, Stereochemistry, Reaction Kinetics etc.

Graphene protrusion for hydrogen storage

The curvature of graphene is a powerful tool for engineering the properties of graphene. It was demonstrated as a flexible approach for tuning the chemical activity,1 and the troughs and valleys in buckled graphene were shown to favour the dissociative and physical adsorption of hydrogen, respectively.2 Inspired by this, we have theoretically proposed a hybrid graphene sheet with a nanohorn, simply a "protrusion" structure as a storage material for various gases. The structure provides a large concave surface at the bottom of the protrusion and a small tip which can be easily passivated. The protrusion, which was constructed as a graphitic cone, is composed in a way that it offers chemically active sites for gaseous adsorption. For effective storage, the threshold binding energy is 0.16 eV for molecular H_2 at ambient temperature and pressure.3 Our findings demonstrate that the average binding energy calculated is ~0.21 eV, still better than pristine graphene (0.108 eV), making it a potential candidate for reversible hydrogen storage devices.

Yashika Sharma
Foserra Photovoltaic Pvt Ltd, India

Structural and thermal relaxation in binary Ge-Te chalcogenide glass

The present and foremost challenge in implementing PCM as possible candidate for memory applications lies with the limitation of storage density which can be solved by carrying through the multilevel storage concept. Basically, the aging process causes the demotion in the progress of multilevel storage devices because of the changes in the physical properties. In the present work we investigate the effect of aging phenomena on the thermal, electrical, and optical properties of bulk Ge20Te80 glass by performing the modulated differential scanning calorimeter (MDSC), impedance spectroscopy and UV-Vis spectroscopy. In this work, Ge20Te80 glass has been aged by subjecting to different temperatures. Thermal studies have shown systematic changes with respect to aging temperature in terms of glass transition temperature, enthalpy relaxation and jump in specific heat capacity and analysed the obtained results in terms of structural aspects by using Raman spectroscopy. Further, we confirm the role of neutral and charged defect states on electrical conductivity of aged glass specimens. The density of neutral defects is estimated via dc conductivity data analysis with respect to the aging temperature. It is found that increment in the temperature induces the paramagnetic defects via thermal excitation and thus single polaron hopping contribution starts dominating at higher temperatures while bipolaron hopping dominates at low temperatures.

Amrita Ghag
The Knowledge Society, Canada

Biography

Amrita is a sophomore IB student and student at The Knowledge Society. She is 15 year old with passions for science & technology, and am currently super interested in researching the potential Nuclear Fusion and AI. She always looking to talk to others on the topic of fusion, or anything at all! She love feedback and personal growth, and am always looking forward to connecting with others.

Integrating Surrogate Modelling Techniques for Enhanced Fusion Plasma Control and Predictability

My research investigates the usage of surrogate modelling techniques in the field of plasma control in nuclear fusion tokamak plasmas. Nuclear fusion stands as a possible answer to a sustainable and clean energy source. However, it comes with additional complications, especially in plasma control. This paper explores the difficulties associated with plasma behaviour and the usefulness of surrogate models in overcoming these difficulties. It examines many approaches, such as Artificial Neural Networks, Bayesian Networks, and Gaussian Process Regression, and how effective they are in simplifying and complex plasma behaviours. It takes a dive into the evolution of surrogate modelling, comparing it to traditional modelling techniques while highlighting its advantages in computational efficiency. Additionally, understanding the complicated dynamics of plasma in fusion reactors is a major focus of the research. The interaction between surrogate modelling and plasma control is carefully looked at, emonstrating how these models can provide innovative opportunities for plasma

control and simplification. Finally, the research not only looks at the significance of surrogate

modelling, but it also suggests future research directions. These include the creation of more advanced AI-driven surrogate models, the investigation of new fusion reactor materials, and a better understanding of plasma instabilities. The entire combination of research shows how surrogate modelling can be used to achieve fusion energy. Despite technological, scientific, and computational challenges, fusion energy with the help of surrogate models holds the possibility of contributing to a more sustainable world.

A Guillermo Bracamonte
National University of Cordoba, Argentine

Biography

A Guillermo Bracamonte, PhD in Chemical Sci., holds an assistant professor position at UNC and research position at CONICET (Commission of Research in Science, Argentina). During his research career, he held postdoctoral positions at COPL, Laval University (Quebec), and University of Victoria (British Columbia), Canada. He was research visitor at University of Regensburg, Germany (Bayern), Germany; and researcher at the NASA Astrobiology Institute, and University of Akron (Ohio) USA. Then, he began his own Research Group, in collaboration with other International Researchers, within Nanophotonics, Biophotonics and Nanomedicine.

Tuning Silicon Nano photonics for Nanotechnology, Bio photonics, and Biotechnology applications based on Multi coloured Enhanced FRET light Delivery

In this presentation are introduced, showed, and discussed insights within Enhanced Fluorescence Resonance Energy Transfer (FRET) from the Nanoscale. Thus, Silicon Nano photonics is developed based on designs of Fluorescent Multi-coloured Silica Nanoparticles. In this way, different Laser dyes were incorporated into Silica Nanoplatforms of varied sized to tune non-classical Light Delivery applications. These Nanoplatforms were synthesized by a modified Stöber methodology. By this manner, interesting results were recorded by Static fluorescence and Fluorescence Lifetime Decays. It was showed the control of Enhanced emissions varying Laser dyes compositions and donor/acceptor pairs. Moreover, varied Resolutions and emissions through space and time were showed by Laser Fluorescence Microscopy. Therefore, it is shown perspectives towards Nanotechnology, Bio photonics, and Biotechnology.

Mihaela D Leonida
Fairleigh Dickinson University, USA

Biography

Mihaela Leonida received a MS and a Ph.D. in Chemical Engineering from the Polytechnic University in Bucharest, Romania and a Ph.D. in Bioorganic Chemistry from Wesleyan University in Middletown, CT, USA. At the present, she teaches biochemistry at Fairleigh Dickinson University in Teaneck, NJ, USA. Leonida's research interests are in the field of redox enzyme stabilization and bionanomaterials with biological activity. She is the author of several books and 80 papers published in science journals and conference proceedings.

Antibacterial and Antiphotoageing Agents: Zein-based Nanoparticles Encapsulating Lupulone

Prolonged skin exposure to UV radiation may result in sunburn, inflammatory and oxidative stress to the skin, skin photoageing, photocarcinogenesis, even DNA damage. Due to the advantages they offer, high encapsulation efficiency, increased stability of encapsulated bioactive agents, release control, nanoparticulate materials have been used in sunscreens in spite of the hazard they present: their capacity to penetrate the skin causing toxic side effects (especially the chemical sunscreens). This study reports the preparation of nanoparticulate composites containing only GRAS substances through an eco-friendly, procedure. The ingredients used have properties beneficial to the skin. Zein (Z), a prolamin-rich protein from corn, is biodegradable and biocompatible, is a moisture attracter, and shows effective absorption by cells. Lupulone (L), extracted from hops, is an antibacterial and antioxidant agent with stimulating effect on collagen production in the body due to its content of phytohormones. Gum arabic (GA) is a natural glycoprotein used in beverages, and cosmetics as emulsifier/stabilizer. Composite matrices containing Z/GA/L were prepared using a simple method (antisolvent) which replaces the flammable solvent ethanol with aqueous propylene glycol. The nanocomposites were characterized by FTIR, composition, encapsulation efficiency/loading capacity for L, size, zeta potential, morphology (SEM). Their biological activity was investigated as well. The zein-based nanoparticles showed antioxidant and antimicrobial effects (even some synergistic, unexpected behavior) and modulatory activity on matrix metalloproteinase MMP-1. Due to their properties these nanoparticles show potential for use in formulations for the skin (especially mature skin), replacing chemical substances with potential side effects used typically in topical delivery systems..

Abhinav Ganesh
USSB, USA

Biography

Abhinav (Montu) Ganesh is a passionate CCS Physics student with a double major in mathematics and a minor in astronomy. He is interested in pursuing space research, specifically astrophysics with practical applications. He's willing to take any measures necessary to master the fields of physics and advanced mathematics and apply them to space research. Abhinav plans to go to as great of a grad program as possible for his fields of interest and gain lots of experience through advanced classes, tournaments, research, fellowships, internships, and outreach.

Condensed Matter Physics Simulation to Measure Cosmic Ray Distributions on an MKID Instrument

G4CMP simulates phonon and charge transport in cryogenic semiconductor crystals using the Geant4 toolkit. This transport code can simulate the propagation of acoustic phonons as well as electron and hole charge carriers. Processes for anisotropic phonon propagation, oblique charge-carrier propagation, and phonon emission by accelerated charge carriers are included. The simulation reproduces theoretical predictions and experimental observations such as phonon caustics, heat-pulse propagation times, and mean charge-carrier drift velocities. In addition to presenting the physics and features supported by G4CMP, this applications in dark matter and quantum information processing. These fields are applying G4CMP to model and design devices for which the energy transported by phonons and charge carriers is germane to the performance of superconducting instruments and circuits placed on silicon and germanium substrates. We used the G4CMP simulations and the Geant4 toolkit to simulate cosmic ray distributions on a charge-coupled device (CCD) that uses Microwave Kinetic Inductance Detectors (MKIDs). Using data containing cosmic rays from a real-life MKID instrument, we plotted the distribution of vibrating phonons over 12 different timeframes spaced 5 microseconds apart. The next step is to find the propagation rate of the phonons as they travel radially outward via a random-walk pattern at the microscopic phonon level.

Mark S Kozdras
Natural Resources Canada, Canada

Biography

Mark Kozdras is a professional engineer and emeritus materials scientist at Natural Resources Canada (NRCan). Kozdras received his PhD in Mechanical Engineering from the University of Waterloo, has 21 years' experience in automotive product development and materials research as well as 11 years managing automotive materials research at NRCan. He is the Canadian co-lead of the Materials for Energy Innovation Platform of Mission Innovation. Within this role, he promotes international collaboration in the deployment of Materials Acceleration Platforms (MAPs), autonomous or self-driving laboratories for clean energy materials, and supports several projects that integrate accelerated materials discovery concepts. Kozdras is a principal investigator in the German-Canadian Materials Acceleration Centre.

Towards a Self-driving Lab for Nanoparticle Research

Society is currently confronted with two global challenges, climate change and sustainable development. This reality reverberates amongst the leading nations of the world and is articulated as a priority by the United Nations through the Framework Convention on Climate Change and its seventeen Sustainable Development Goals. In 2016, under the Paris Accord, Mission Innovation, MI, emerged as a global response to climate change and developed eight innovation challenges to mitigate its effect, including Clean Energy Materials, IC6. This innovation challenge focused its efforts on accelerating the development and deployment of clean energy materials by more than a factor of ten through Materials Acceleration Platforms, MAPs – autonomous, self-driving materials laboratories and renewed itself under the current mandate as Materials for Energy, M4E. Self-driving labs deploy artificial intelligence, robotic automation and high-performance simulation and modeling in a closed loop system of material synthesis and characterization. An international ecosystem for accelerated materials discovery has been established and finds applications in many enabling materials technologies, including nanomaterials. The importance of nanomaterials to catalysis for hydrogen production and carbon dioxide conversion as well as energy storage in batteries is well known. In this work, the international efforts under Materials for Energy will be elaborated including the development of MINERVA - MAP for Intelligent Nanomaterial synthesis Enabled by Robotics for Versatile Applications. MINERVA was specifically built to include the specialized equipment required for the synthesis, characterization and closed-loop optimization of various nano- and advanced materials, ranging from simple inorganic (silica, metal, metal oxide) or polymeric nanoparticles to more complex core-shell architectures and materials with well-defined porosity or surface chemistry. Currently, we are investigating materials for applications in antimicrobial and antibiofouling surface coatings, sensor materials, as well as the reproducible synthesis of reference materials with this platform.

Bradley R Williams
Moxtek, USA

Biography

Brad Williams has accumulated over twenty years of experience as a process engineer, starting in semiconductor manufacturing at renowned companies such as Motorola, AMI, and ON Semiconductor. Over the last twelve years, he has been dedicated to research and development process within optical manufacturing at Moxtek. In his most recent position, he led process development in nanoimprint lithography and etch processing, emphasizing the creation of superior manufacturing processes for optical devices and metasurfaces.

Mass Production of Meta-Optics in the Visible to Near Infrared by NIL Patterning

Meta-optics have just recently started to move from lab research into commercialized applications. Meta-optics are arrays of subwavelength meta-atoms that locally control the wave front of transmitted and reflected light. For meta-optics tuned to visible wavelengths, the meta-atoms have feature sizes that are difficult to resolve using conventional UV lithography methods. These very small structures can be easily resolved by E-Beam Lithography (EBL), but this patterning method is not suitable for volume production. At Moxtek we have established a manufacturing line enabled by nanoimprint lithography (NIL) that can pattern and build visible range meta-optics at scale. This process has proven to be able to fabricate meta-optics with total efficiency greater than 90% at 532nm wavelength on a baseline over multiple lots. In this paper we will demonstrate that NIL is the key patterning process step that enables visible metalens volume production. We have Modulation Transfer Function (MTF) and efficiency baseline data across many different lens designs. The dataset is comprised of multiple lots to provide a statistically significant baseline of stability and repeatability metalens performance data. NIL has proven ideal for high volume stability and fidelity.

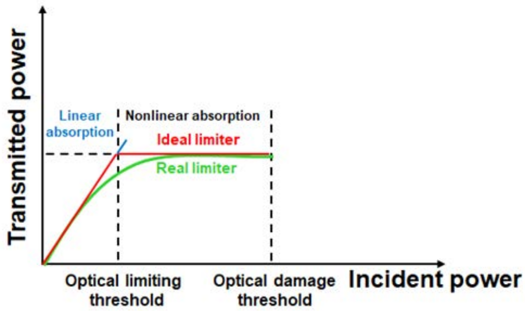
Petronela Gheorghe
National Institute for Laser, Plasma and Radiation Physics, Romania

Biography

Petronela S. Gheorghe graduated from Faculty of Physics, at the University of Bucharest. In 2004, she obtained her MSc Degree in Physics at the University of Bucharest, Faculty of Physics, studying "Methods for the characterization of the nonlinear optical materials", coordinated by Acad. Prof. Valentin I. Vlad and Dr. Adrian Petris. She obtained the scientific title of Doctor in Physics from the same Faculty, in 2016 with the thesis "Nonlinear optical properties of micro-structured materials", supervised by Acad. Prof. Dr. Valentin I. Vlad. She works as a scientific researcher at the National Institute for Laser, Plasma and Radiation Physics, Department of Lasers, in Nonlinear Optics and Photonics Group.

Study of optical limiting properties in DNA-based materials functionalized with Turmeric dyes

Lasers, which are now widely used in many applications, can represent a potential hazard to the eyes and other sensitive optical and optoelectronic devices due to laser-induced damage. Therefore, the protection measures against their high-intensity radiation are extremely important. Optical limiting is the phenomenon of reducing the optical transmission of a material with increasing laser power/fluence [1-3].



Optical limiting functionality

For the ideal OL the transmitted power/intensity has a linear increase for incident power/intensity up to the OL threshold, remaining constant after this. For a real OL, the transmitted power/intensity depends nonlinearly on the incident one, being described by a saturation curve.

In this work, we study the optical limiting potential of a new class of deoxyribonucleic acid (DNA) bio-polymer functionalized with natural dyes by the Intensity-scan (I-scan) [4-7] in the NIR spectral domain at the wavelength of 1550 nm, which is important in telecommunications. The optical transmittance value, in the linear regime, the OL threshold, and the saturation intensity of the nonlinear transmission curves were determined. The influence of DNA biopolymer and of natural dye concentration on the limiting optical properties of the investigated biomaterials is also reported and discussed. Our results indicate the positive influence of DNA, which incorporates natural dyes, on the optical limiting functionality. This study revealed the potential for optical limiting of the investigated class of new biomaterials with photonic applications.

Iuliana Urzica
National Institute for Laser, Plasma and Radiation Physics

Biography

Iuliana Urzica , obtained her BS in physics from the University of Bucharest in 2002 with the thesis "Infrared imaging methods for medical diagnostics". She obtained her MS from the same university in 2004 with the thesis "Optical methods in Nano metrology of microsystems". Since 2002 she was a researcher with the Laser Department of the National Institute for Laser, Plasma and Radiation Physics, Majorelle, Romania. She obtained in 2011 a PhD degree in optical engineering at the Polytechnic University, Bucharest, Romania on the topic of Nano metrology: "Methods and techniques in the Nano metrology of microsystems".In February 2004 she attended the "Winter college on interferometry and application modern physics" (Trieste, Italy) and in May 2006 she attended the "Enrico Fermi" International School of Physics, the course on Metrology and Fundamental Constants (Varenna, Italy). 2009 - 2011: teaching at the University Politehnica of Bucharest, Faculty of Electronics, Telecommunications and Information Technology, department Electronic Technology and Reliability for MSc students I and II.

Frontiers in Microfluidics

Nature is the inspiration for many innovations and continue to serve as an invaluable resource to solve technical challenges. The lotus leaf, the rice leaf, the butterfly wing, and the water-strider spider legs have surfaces that possess several uniquely beneficial properties, such as extreme water repellency, self-healing, self-cleaning, anti-bacterial, anti-corrosion, enhanced heat transfer, drag reduction and improved corrosion resistance. Recently, superhydrophobic surfaces, for which the water contact angle is higher than 150° and sliding angle less than 10°, have received attention due to the many potential applications ranging from biological to industrial processes and usable/ applicable properties, not only scientific but even in daily life.

In this paper, an innovative, flexible and low-cost experimental set-up for producing superhydrophobic metal surfaces that are modeled by nanosecond pulsed laser ablation is shown. One of the goals of this patterned superhydrophobic metallic surface is to obtain a device to be used in sample surface preparation of polymeric materials such as polydimethylsiloxane-PDMS, polyethylene terephthalate-PET, synthetic latex polymers, polyvinyl chloride-PVC. The polymeric structures have the same properties as those of the metal pattern used to generate them and are employed in a large number of applications in biology, the food industry, the marine industry, and the textile industry.

3rd Edition International Conference on

Optics, Lasers and Photonics

March 25-26, 2024 | Barcelona, Spain

e-Poster

Moufida Laghbeche
Hassiba Benbouali University of Chlef, Algeria

Biography

Moufida Laghbeche is a new researcher in theoretical physics. She completed her master's degree under the supervision of Mr. A. Berbri, and her thesis topic was on dust acoustic shock waves in magnetized dusty plasma (2022). Now she's preparing for a PhD competition. During her studies at three different universities, she studied most theoretical physics topics. Her research interests lie in astrophysics, specifically in understanding the behaviour of dust particles in different fields of physics.

Cylindrical Dust Acoustic Shock Waves in a Self-Gravitational Magnetized Dusty Plasma Compared with Black Hole Plasma

Understanding the intricate interplay between self-gravitational effects and shock waves in dusty plasma is paramount to unravelling the mysteries of cosmic phenomena. This study investigates the propagation and characteristics of dust acoustic shock waves (DAShWs) in a self-gravitational magnetized dusty plasma with kappa-distributed electrons and ions. The need to understand the behaviour of shock waves in complex plasma environments and their potential similarities with astrophysical phenomena, such as black holes and various hurricanes that occur in the environment and the universe, motivated this investigation.

To explore the dynamics and collisions of dust acoustic shock waves in the specified plasma environment, this study employs theoretical and analytical methods. In this study, we consider a dusty plasma comprising negatively charged massive dust grains and super-thermal electrons and ions following the kappa distribution.

Our research reveals that super-thermal ions and electrons significantly affect the properties of dust acoustic shock waves. We compared our results with those of black-hole plasma and found that their structures are similar.

The study of dust acoustic shock waves in a self-gravitational magnetized dusty plasma with kappa-distributed electrons and ions provides valuable insights into the properties and behaviour of such systems in various environments. A comparison with black-hole plasma provided further insights into the role of self-gravitational forces and their effects on plasma behaviour.

UPCOMING CONFERENCES

4th Edition International Conference on **Optics, Photonics and Lasers**
March 19-20, 2025 | Amsterdam, Netherlands
david@scholarsevents.org
https://scholarsconferences.com/optics-photonics-lasers/

3rd Edition International Conference on **Physics and Quantum Physics**
March 19-20, 2025 | Amsterdam, Netherlands
david@scmeetings.org
https://scholarsconferences.com/physics/

2nd Edition World Congress on **Material Science and Nanotechnology**
March 19-20, 2025 | Amsterdam, Netherlands
advancedmaterials@scmeetings.org
https://materialssciencemeet.com/