# CMPQM-2025

## International Experts Summit on
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**Abstract Book**


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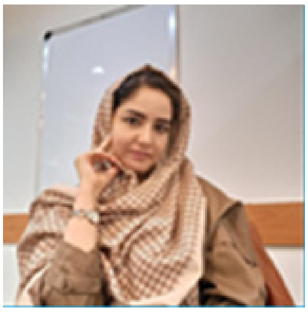

## Elham Khorashadizade

*Pasargad Institute for Advanced Innovative Solutions (PIAIS), Tehran, Iran*

# Optimizing Photoelectrochemical water splitting efficiency of $TiO_2$ nanotubes through anodization configuration

## Abstract

Given the crucial demand for green energy solutions, hydrogen has emerged as a viable alternative to fossil fuels through sustainable methods. Consequently, the development of effective and well-designed photocatalysts that harness solar energy is a critical challenge. In this reseach a systematic experimental study was conducted on the arrangement of various components in the titanium foil anodization process, particularly focusing on the position of the anode and cathode electrodes in relation to one another, as well as their placement within the electrolyte. To achieve this objective, three distinct cell designs have been developed. Within these cells, the anode and cathode electrodes may be arranged either in parallel (para) or in a vertical (perp) orientation. Furthermore, during the anodizing process, one or both surfaces (1 side or 2 sides) of the electrodes can be in contact with the electrolyte. Titanium dioxide nanotubes with varying morphologies and thicknesses were fabricated using each cell (please see Figure 1). Consequently, this variations have a direct impact on the photoelectrochemical performance of the electrodes designed for hydrogen production. Table 1 presents the thickness, inner diameter, and outer diameter measurements of fabricated nanotubes using three distinct configurations for anodization cells by the image j software.

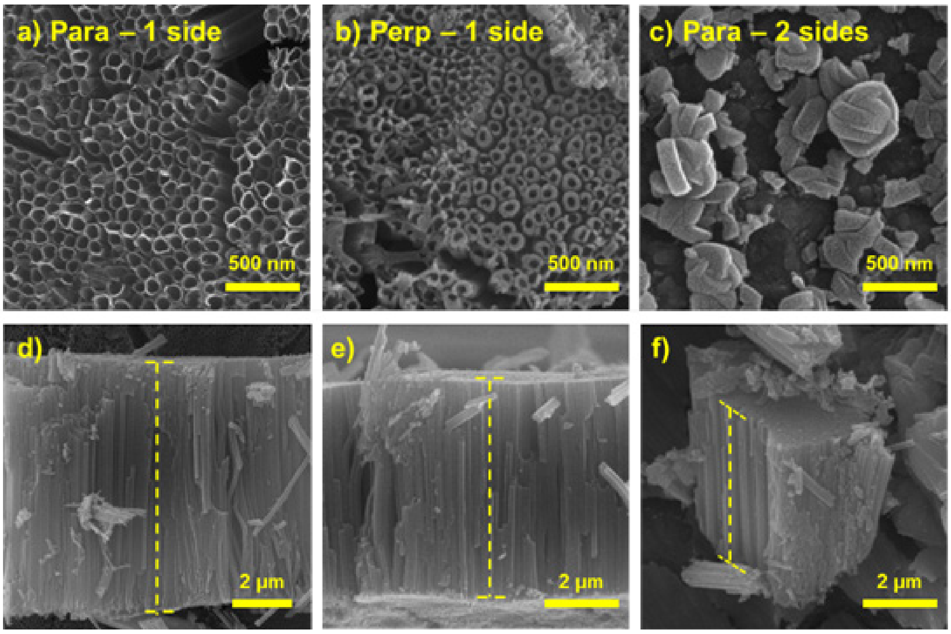


Figure 1. (a-c) top view and (d-f) (e) cross-sectional FE-SEM images of oxide nanotube structures grown on pure Ti foil, employing three distinct configurations for anodization cell.

Table 1. Thickness, inner diameter, and outer diameter measurements of fabricated nanotubes employing three distinct configurations for anodization cell.

| Sample name | Thickness (µm) | Inner diameter (nm) | Outer diameter (nm) |
|---|---|---|---|
| **Para – 1 side** | 7.9 | 63.3 | 92.1 |
| **Perp – 1 side** | 5.8 | 51.7 | 89.8 |
| **Para – 2 sides** | 4.4 | 58.4 | 99.0 |

## Biography

Elham Khorashadizade received her Ph.D. in condensed matter physics from Sharif University of Technology, Tehran (Iran) in 2021 and carried out her Ph.D. thesis on "Improving Photoelectrochemical Performance of Nanotube and Nanoflake Titanium Dioxide by Oxygen Vacancy Defect". She joined Pasargad Institute for Advanced Innovative Solutions (PIAIS), Tehran (Iran) in 2022. Her current interests focus on the synthesis, characterization and application of nanostructures and nanomaterials as well as improving the performance of metal oxide materials such as $TiO_2$ by defect engineering for photocatalytic hydrogen production via water splitting and fabrication and characterization of solar cells. Moreover, she has patented some national ideas as follow:

1. Multi-purpose economic electrochemical cell with an accurate electrode's surface exposed to the electrolyte.
2. Manufacturing special antibacterial nanostructure with core/shell/shell nanostructure
3. Designing and manufacturing a solar system for disinfection of polluted water (more useful in the case of pool water).

**Abraham Motolani Akinwole**

*Precious Cornerstone University, Nigeria*

# Methodical Control of Off-Grid Solar Photovoltaic Systems for Optimized Energy Efficiency: A Review

## Abstract

This review explores methodical control strategies in Maximum Power Point Tracking (MPPT) for off-grid solar photovoltaic (PV) systems, with a focus on optimizing energy efficiency, system reliability, and security. As global demand for sustainable, clean, and decentralized energy solutions continues to rise—especially in remote, underdeveloped, and developing regions—the need for intelligent control methods in off-grid PV applications becomes increasingly critical. While conventional MPPT control methods are widely used to maximize power conversion efficiency under conditions such as partial shading, recent research has increasingly focused on soft computing and bio-inspired approaches. This study reviews the relevance, strengths, and trade-offs of selected bio-inspired algorithms that have been widely applied in off-grid PV system control, highlighting their impact on system performance and sustainability. Additionally, the paper briefly introduces a conceptual idea for a novel MPPT approach, termed the Eagle Phenomenal Algorithm (EPA)—inspired by the adaptive precision and resilience of avian hunting behavior. Although the algorithm remains theoretical at this stage, it is proposed as a potential direction for future research. Ultimately, this work contributes to ongoing efforts in renewable energy innovation and supports the global pursuit of Sustainable Development Goals (SDGs), particularly in clean energy access, climate action, academic and research engagement, energy equity, and technological development.

## Biography

Akinwole Abraham Motolani graduated as the valedictorian with a B.Sc. in Physics with Electronics from Precious Cornerstone University, Ibadan, Nigeria. He has a growing research interest in condensed matter physics, quantum materials, and next-generation energy devices. His thesis, titled Design and Development of a Vehicular Speed Detector for Use on Nigerian Roads, employed experimental techniques to address traffic monitoring challenges. Abraham contributed to the EnSat project, a student-led initiative to build a miniature environmental satellite aimed at recording and analyzing environmental parameters such as pressure, temperature, and humidity levels. He has interned at the National Space Research and Development Agency (NASRDA) in Abuja, gaining practical experience in space technology. Currently undergoing training in Artificial Intelligence and Machine Learning organized by Digital Skillup Africa, he aims to

integrate computational methods into his research. Member of the Nigerian Institute of Physics, he aspires to pursue a Ph.D. in condensed matter physics to further his research in quantum materials and their applications in sustainable energy systems. His work explores the interface between advanced photovoltaic technologies and practical electronic applications. He is currently seeking hands-on research opportunities and graduate-level training to further develop his expertise

## Alamgir Khan

*Alamgir,Khan*

# Analysis of pT spectra for φ (1020)0 mesons in Au–Au collisions at 200 GeV, using PYTHIA and Tsallis function

## Abstract

The $\phi(1020)^0$ mesons produced by asymmetric $Cu$–$Au$ collisions at $\sqrt{s_{NN}} = 200$ GeV in the pseudorapidity region of $|\eta| < 0.35$ is studied in relation to the transverse momentum ($p_T$). The nuclear modification factor ($R_{AB}$) is also calculated for $\phi(1020)^0$ mesons. To validate the model's predictions, the simulations are compared to the experimental data from PHENIX using the PYTHIA8 and tuned to color reconnection mode. A systematically close relationship exists between PYTHIA8 predictions and the PHENIX data. PYTHIA CR1 mode predictions do not agree well with PHENIX experimental data. In addition to the $R_{AB}$ predictions, we investigated the ratio between the production of $\phi(1020)^0$ mesons to $K^*(892)^0$ mesons and $\Lambda$ baryons in $Cu$–$Au$ collisions at $\sqrt{s_{NN}} = 200$ GeV. A comparison of the $\phi(1020)^0$ mesons yield produced by symmetric $Au$–$Au$ and $Cu$–$Cu$ collisions at $\sqrt{s_{NN}} = 200$ GeV are conducted using PYTHIA8 for comparison against asymmetric $Cu$–$Au$ collisions. In this study, we also fit thermodynamically consistent Tsallis distribution functions for $\phi(1020)^0$ mesons onto experimental RHIC (PHENIX) $p_T$ spectra obtained from $Cu$–$Au$ collisions at $\sqrt{s_{NN}} = 200$ GeV energy.

## Biography

I am PhD Physics student at International Islamic University Islamabad. I have 8 publications in high energy physics, and some of my publications are still in publication process.


## Pei-Yi Feng

*Pei-Yi Feng, Xi-Lei Sun, Zheng-Hua An, Hong Lu, Xin-Qiao Li, Shao-Lin Xiong Key Laboratory of Particle Astrophysics, Institute of High Energy Physics, Chinese Academy of Sciences, Beijing 100049, China*


# The energy response of $LaBr_3$ (Ce), $LaBr_3$ (Ce, Sr), and NaI (Tl) crystals for GECAM


## Abstract

The Gravitational wave burst high-energy Electromagnetic Counterpart All-sky Monitor (GECAM) series satellites utilize LaBr3(Ce), LaBr3(Ce,Sr), and NaI(Tl) crystals as the sensitive materials for gamma-ray detectors (GRDs). To investigate the nonlinearity in low-energy gamma-ray detection and address the errors in the energy-channel (E-C) calibration, we conducted comprehensive testing and comparative studies of these three crystals using Compton electrons, radioactive sources, and monoenergetic X-rays. The nonlinearity test results for Compton electrons and X-rays revealed significant differences, with all three crystals exhibiting greater nonlinearity for X-rays compared to Compton electrons. Although LaBr3(Ce) and LaBr3(Ce,Sr) crystals demonstrate higher absolute light yields, their light yields show a pronounced "defect" nonlinearity at low energies, particularly below 400 keV. The NaI(Tl) crystal displays "excess" light output in the 6-200 keV range, indicating a significant advantage in low-energy gamma-ray detection. We discuss the potential causes of crystal nonlinearity. By employing a combined experimental and simulation approach, we quantified seven factors influencing energy resolution, discovering that the contributions of each component vary, primarily due to photoelectron statistical fluctuations and intrinsic resolution. We identify two sources of intrinsic resolution: nonlinearity and fluctuations in the energy transfer process. Our findings indicate that the proportions of these two sources of intrinsic resolution differ significantly among the various crystals.

## Biography

She is currently 26 years old and has just obtained her Ph.D. from the Institute of High Energy Physics, Chinese Academy of Sciences. During her master's and doctoral studies, she was deeply involved in the development of the GECAM satellite payload and was a key member of the team. She has published over 20 papers in renowned journals and received multiple honors in the fields of particle detectors, space radiation detection technology, and high-energy astrophysics

## Kalyandurg Annapurna

*Specialty Glass Division, CSIR-Central Glass and Ceramic Research Institute, 196, Raja S. C. Mullick Road, Kolkata 700 032, India*

# Advanced Photonic Applications of Mid-IR transmitting Glass-Ceramics

## Abstract

In recent time, continuous progress in the field of photonics demands a wide transparency window, low phonon energy matrix that will be suitable for active (Mid-IR laser gain) as well as advanced applications (optical limiting, optical switching, harmonic generation etc.,). Lanthanide-tellurite glass-ceramics are one such kind of monolithic matrix manifesting prosperity of “anti-glass” $Ln_2Te_6O_{15}$ crystals in an IR-transmitting glass for diverse photonic applications. The specialty of “anti-glass” crystallite is their low light scattering behaviour generated from non-stoichiometric oxygen vacancies containing structure. As a result, fabricated glass-ceramics display ultra-transparency similar to their parent glass. The glass-ceramics co-doped with multiple luminescent lanthanide ions ($Er^{3+}$-$Ho^{3+}$-$Dy^{3+}$) exhibit broadband 3 μm emission with effective bandwidth ($\Delta\lambda_{eff}$) ~400 nm, which is highest in the literature. Further, tellurite glass-ceramics exhibit ~$10^3$ times higher third-order non-linearity [$\chi^{(3)}$ =3.65×10-11 esu, three photon absorption co-efficient ($\alpha_2$)=1.9×10-10 m/W and non-linear refraction ($n_2$)=2.1×$10^{-17}$ $m^2$/W] than fused silica and at least ten times larger values than reported heavy metal oxide glass/glass-ceramics. These large third-order non-linearity is originated from lone-pair containing polarizable glassy network of $TeO_2$ glass, and asymmetry of oxygen deficient $Ln_2Te_6O_{15}$ crystallites. Optical limiting threshold obtained for lanthanide-tellurite glass-ceramics is 5.4 mJ/$cm^2$, that is much lower compared to $WSe_2$ (21.6 mJ/$cm^2$), conjugated organic molecules (117 mJ/$cm^2$), graphene oxide (37 mJ/cm2), carbon nanodots (74 mJ/$cm_2$), or $MoS_2$ nano-sheets (44 mJ/$cm^2$). Comparing the limiting threshold values in can be concluded that current matrix is highly suitable for optical limiting application.

**AmitKumarVerma**

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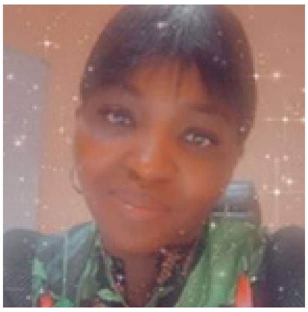
# Tailoring the Properties of $WO_3$ via 120 MeV $Ni^{7+}$ beam Irradiation: A Pathway to high-performance Hydrogen Sensor

## Abstract

The development of high-performance hydrogen sensors is essential for several industrial and environmental applications. The 120 MeV $Ni^{7+}$ Swift heavy ion beam with a fluence of 1× 1013 ions/cm$^2$ irradiated on spin-coated $WO_3$ thin films. The irradiated $WO_3$ film was studied for hydrogen gas sensing at an optimized temperature. Characterization techniques including XRD, Raman, AFM, FESEM, UV-Vis, and FTIR were employed to analyze optical, morphological, and structural characteristics of pre- & post-irradiated thin films. The crystallite size was reduced from 39.8 to 26.2 nm and no phase change occurred after the irradiation. The reduced peak intensity obtained from the XRD pattern revealed a reduction in crystallinity. The reduced intensity in Raman peaks validated XRD results by pointing to the decrease in crystallinity. Post irradiation, the energy transfer from the strong $Ni^{7+}$ion beam to the lattice through electron-phonon coupling (electronic energy loss) caused the surface roughness to rise. The Nano-cuboidal-like structures of pristine film showed structural distortion post-irradiation. The relative sensing response for irradiated film compared to pristine film improved from 45.02% to 67.70% with exposure to the 75 ppm hydrogen gas concentration at 100 °C. The recovery and response time significantly improved for the irradiated film. The results indicate that ion beam irradiation is a feasible method for enhancing $WO_3$-based hydrogen sensors, facilitating the development of next-generation gas sensing systems with enhanced performance.



## Deji-jinadu Boluwatife Banke

*Bowen University, Iwo, Osun state, Nigeria*

# EffectsofModifiedHylleraaspotentialonsomeThermodynamic properties using the Nikiforov-Uvarov (NU) method

## Abstract

Schroedinger euation (S.E) is a linear partial differential euation that governs the wave function of a quantum system. It comprises of the bound state, the scattering state and the theroretic quantities. Different potentials have been used to solve the Schroedinger equation. For this study, a modofied Hylleraas potential is used. Initially, the effects of temperature and maximum quantum states have always been considered in discussing thermodynamic properties of a system. But recently, the relationship between quantum mechanics and thermodynamic properties have been established. Hence, potential(s) at different energy levels have been used to describe the thermodynamic properties of a system. Potential(s) however, has different parameters and the effects of these parameters are considered on the thermodynamic properties. So, the potential is first modified hence the name Modified Hylleraas potential; then the potential is solved for by the Nikiforov- Uvarov (NU) method which helps us derive the energy E and thus the partition function. From this partition function the thermodynamic properties are thus obtained.

## Biography

She is obtained her BSc with a first class in Physics & Solar Energy in 2009 at from Bowen University, Iwo Osun State Nigeria. She then after her compulsory National Youth Service proceeded to the University of Ibadan for her MSc, which she obtained in 2014 with unwavering interest for the Theoretical aspect of Physics. As lover of mathematics, she loves to play around with euations, and hd previously when she was a college student in 2000 represented her college Christs' ambassadors International College; Ibadan, Oyo state, Nigeria in a Cowbell

Mathematics
Competition for Colleges organised by Promasidor Nigeria Ltd. She has about a decade experience in teaching, lecturing, mentoring, supervion of undergraduate students' projects, student-level advisory and students'-counselling which she has effoertlessly done over the years. She has also served faithfully in different capacities, various administrative positions in the Bowen University system and even in other non-academic systems. She is cutrently a PhD student in the Physics Program of the afore-mentioned university in the Theoretical/ Mathematical Field of Physics.

## Dr. Birojit Das

*Department of Mathematics (AIASK), Amity University Kolkata, India*

# Application of operation approach in fuzzy bitopological spaces

## Abstract

The central aim of this treatise is to delineate the concept of the $(i,j)_\gamma$^* -operation within the framework of fuzzy bitopological spaces. This operation is subsequently employed to investigate the notion of $(i,j)^*$-fuzzy open sets in a specified fuzzy bitopological space. The existence of these constructs is substantiated through the invocation of various operational methodologies. A comprehensive exposition of the properties associated with the newly introduced concept is presented, underpinned by pertinent examples to elucidate the justifications. In addition, the notion of minimality in fuzzy open sets is explored to a considerable extent. Finally, significant results concerning the local finiteness of a given fuzzy bitopological space are derived through the operation-based approach.

## Biography

Dr. Birojit Das is an Assistant Professor in the Department of Mathematics at Amity University Kolkata, India. He earned his Ph.D. in Mathematics, specializing in uncertainty theory. His research focuses on the application of fuzzy mathematics and uncertainty theory in sequence spaces and bitopological spaces. Dr. Das has published over 40 research articles in SCIE/Scopus indexed journals and serves as a reviewer for 15+ internationally reputed journals. He has delivered invited speeches at prestigious institutions, including Tsinghua University (China), Ramthakur College (India), and the 5th ICAMIS (China), among others. In addition to his research, Dr. Das is dedicated to fostering academic collaboration and advancing the study of mathematical uncertainties. He has collaborated with renowned academics globally and continues to contribute significantly to the academic community through his research and speaking engagements. His work bridges theoretical mathematics with practical applications, making a substantial impact on the field.

## Keltoum DRIS

*Department of Physics, Khadir Mohideen College, Adirampattinam, Thanjavur District, Tamil Nadu 614701, India*

# Performance Improvement of Lead-Free Perovskite Solar Cells Through Numerical Simulation Using SCAPS 1D

## Abstract

Perovskite solar cells (PSCs) are highly promising optoelectronic devices for solar energy conversion, with conversion efficiencies reaching up to 25.2%. However, challenges related to performance enhancement and stability remain. This study investigates the impact of the active layer thickness and defect density on the photovoltaic performance of a perovskite solar cell (Pt/PEDOT:PSS/$CsSnCl_3$/FTO) using SCAPS 1D. The chosen configuration excludes a Hole Transport Layer (HTL), and the selection of $CsSnCl_3$ as the active material is based on its potential to improve PSC performance. The results demonstrate that, for an active layer thickness of 700 nm and a defect density of $10^{14}$ $cm^{-3}$, the cell exhibits remarkable performance, with an open-circuit voltage (Voc) of 1.34 V, a short-circuit current density (Jsc) of 24.78 mA/$cm^2$, a fill factor (FF) of 90.45%, and a power conversion efficiency (PCE) of 30.07%. These findings emphasize the critical role of optimizing both the thickness and defect density of the active layer to enhance PSC performance. The use of SCAPS 1D as a simulation tool has proven effective in predicting and optimizing solar cell performance, providing promising prospects for the development of more efficient perovskite solar cells.

## Adrita Chakraborty

*Faculty of Physics and Applied Computer Science, AGH University,30-059,Krakow,Poland*

# Neumann-rosochatius Model in Nonrelativistic Lifshitz Background

## Abstract

We construct one dimensional integrable Neumann-Rosochatius model by choosing a fundamental string as a natural probe rotating and pulsating in the Lifshitz spacetime that follows nonrelativistic anisotropic Lifshitz scaling. We choose the target space as 2+1D Lifshitz spacetime and suitably embed it into a 3+1D hyperboloid by considering a general class of rotating and pulsating string ansatz. The resulting Lagrangians straightforwardly reduce to the Lagrangian of a Neumann-Rosochatius integrable model. We use the solutions of the integrable model to yield energy-momentum dispersion relations. We interpret these string energy states from the perspective of frustrated $J_1-J_2$ spin chain with ground state degeneracy for rotating string and frustration-free Fredkin and Motzkin spin chain for pulsating string.

## Biography

Adrita Chakraborty finished her PhD at 27 years old from Indian Institute of Technology Kharagpur and postdoctoral investigations from Department of Physics, National Tsing Hua University, Taiwan(R.O.C.) and Faculty of Physics and Applied Computer Science, AGH University, Krakow. She has published 7 papers in esteemed journals like Journal of High Energy Physics, Physical Review D, European Physical Journal C and EPJ Web of Conferences. She has other three papers in arXiv submitted to the Journal of High Energy Physics and European Physical Journal C.

## Faisal Alresheedi

*Department of Physics, College of Science, Qassim University, Buraidah, Saudi Arabia*

# The Effects of Titanium Additions on the Structural and Mechanical Properties of Stainless Steel-Nitride Thin Films

## Abstract

This work investigates the influence of Titanium concentration on structure and hardness properties of magnetron co-sputtering of austenitic stainless steel and chromium targets deposited onto silicon substrate in a mixed Ar/N2 gas atmosphere. The coatings structure, composition, morphological, and hardness properties of the films were examined using X-ray diffraction (XRD), scanning electron microscopy (SEM), X-ray photoelectron spectroscopy (XPS), micro-hardness (Knoop indenter), and pin-on-disk, respectively. Composition analysis by XPS showed that Ti concentration decreases with increasing nitrogen concentration. The XRD analysis showed that the coatings nominally have an FCC structure with a displacement of (200) peak from its expected position. The unusual shifted peak of (200) for the austenite stainless steel is normally known as the S-phase which is identified based on the (111) and (200) peak positions. SEM cross-section images show that the grown thin films exhibited columnar structure and with increasing nitrogen content in the films, a smoother surface is observed. The hardness tests show that film with the highest N2 concentration has the maximum hardness observed in this study. This film tends to have the most improved friction coefficient.

## Biography

Dr. Faisal Alresheedi received his PhD degree in 2018 from the University of New Hampshire in the USA under the supervision of Prof. James Krzanowski. After that, he joined the physics department at Qassim University in Saudi Arabia as an assistant professor. His research interests focused on the development and fabrication of thin-film coatings. He specializes in the use of advanced methods for characterizing the properties of materials, such as XRD, XPS, SEM, TEM, AFM, VSM, UV, and spectroscopic ellipsometry.

## Ghislaine Flore Kabadiang Ngon

*University of Yaounde I, P. O. 812 YAOUNDE, CAMEROON*

# Dissipative light bullets in a doped and weakly nonlocal optical fiber

## Abstract

The letter introduces an extended (3+1)-dimensional [(3+1)D] nonlocal cubic complex Ginzburg-Landau equation describing the dynamics of dissipative light bullets in optical fiber amplifiers under the interplay between dopants and a spatially nonlocal nonlinear response. The model equation includes the effects of fiber dispersion, linear gain, nonlinear loss, fiber nonlinearity, atomic detuning, linear and nonlinear diffractive transverse effects, and nonlocal nonlinear response. A system of coupled ordinary differential equations for the amplitude, temporal, and spatial pulse widths and position of the pulse maximum, unequal wavefront curvatures, chirp parameters, and phase shift is derived using the variational technique. A stability criterion is established, where a domain of dissipative parameters for stable steady-state solutions is found. Direct integration of the proposed nonlocal evolution equation is performed, which allows us to investigate the evolution of the Gaussian beam along a doped nonlocal optical fiber, showing stable self-organized dissipative spatiotemporal light bullets.

## Biography

She is a Ph.D. student at the University of Yaoundé 1 and is about to defend her thesis in public. She has published an article in one of the most prestigious journals, Physical Letters.

## Hossein Vaziri

*Department of Physics, Shahrood University of Technology, P. O. Box 36155-316, Shahrood, Iran*

# Applications of Generalized Parton Distribution Functions In Higher Approximation

## Abstract

Recent parameterizations of parton distribution functions (PDFs) have led to the determination of the gravitional form factors of the nucleons dependence of generalized parton distributions of nucleons in the limit $\xi \rightarrow 0$. This paper aims to obtain the flavor devision of nucleon electromagnetic and gravitional form factor using the VS24 Ansatz and two PDFs at N3L0 approximation in GPDs. PDF and GPD formalism enable the calculation of various form factors of nucleons in different approximations, as well as the calculation of the electric radius of nucleons. The study, despite its high approximation complexity, enhances the accuracy of calculations and brings us closer to the experimental values.

## Biography

I am a PHd student in particle phycics at shahrood university of technology and postdoctoral investigations from UAB university IN Barcelona. I am a teacher, a head physics administration high school. I have Published in excess of 3 papers in rumored diaries.

## Joyce de Mattos Leao

*Programa de Pós-Graduação em Engenharia e Ciências dos Materiais, UFPR, Curitiba – PR*

# Synthesis and characterization of cerium oxide nanowires with controlled diameter obtained by electrospinning

## Abstract

Nanostructured cerium oxide ($CeO_2$) has excellent physical and chemical properties that have attracted great interest in recent decades for applications in technology and biomedicine. In this research, cerium acetate polymer nanofibers are fabricated by electrospinning deposition on a metal target. The nanofibers were transformed into nanowires $CeO_2$ by heat treatment. Different thermal annealing temperatures (from 350 °C to 950 °C) were used, to ensure full conversion to $CeO_2$. Different mass ratios of cerium acetate were used in order to control the diameter of the nanowires. Raman Spectroscopy and X-Ray Diffraction demonstrated complete conversion of the deposited nanofibers into cerium dioxide for all mass ratios. Scanning Electron Microscopy reveals that the nanowires are independent, with diameters ranging progressively from (200 ± 10) nm to (81 ± 5) nm for cerium acetate concentrations ranging from 15%, 10%, 5% and 3%. Transmission Electron Microscopy shows that the morphology of the nanowires is polycrystalline and their sizes are compatible with the results obtained by Rietivald refinement of the X-Ray Diffraction data. As the heat treatment temperature does not seem to affect the nanowire diameter, the main control parameter for this fabrication method is the concentration of cerium acetate in the deposition solution, and the process is found to be highly reproducible.

## Biography

This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brasil (CAPES) – Finance Code 001. Authors also acknowledge financial support from CNPq and Fundação Araucária. Raman and Electron Microscopy techniques were measured at Centro de Microscopia Eletrônica da UFPR. XRD was performed at the Multiuser Laboratory for X-Ray Diffraction, UFPR.

## L. Hachani

*University of carthage, National School of Engineers of carthage, Tunisia*

# Theoretical investigation of the Potential energy Surfaces (PES) For $MgC_4H$-Hc system

## Abstract

Magnesium- Containing molecule, Such as $Mgc_4H$ has been dectected in the interstellor medium (ISM). Magnesium is also one of the most common metals in the solar system making it the most important element in astrophysical and Chemical environments Considering the challenge of exploring experimental data for the collision of $MgC_4H$ with helium He.

In the present work we have performed a new theoretical calculation of the interaction of this complex. the calculations are based on new two-dimensional Potential energy surfaces (PES) obtained from highly Correlated ab initio calculations

This PES was obtained using a coupled cluster open-shell method including all single and double excitations as well as the perturbative Contributions from Contributions from Connected triple Excitations (rccsd(t)-f12) and aug-cc-PUTZ basis gets.

## Leo Georgy Sapogin

*Department of Physics, Technical University (MADI), 64 Leningradsky pr., A-319, Moscow, 125319, Russia*

# Review of New Unitary Quantum Theory

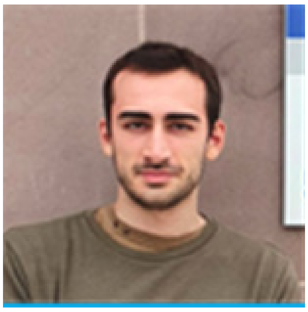
## Abstract

This article describes a model of Unitary Quantum Field theory where the particle is represented as a wave packet. The frequency dispersion equation is chosen so that the packet periodically appears and disappears without form changings. The envelope of the process is identified with a conventional wave function. Equation of such a field is nonlinear and relativistically invariant. With proper adjustments, they are reduced to Dirac, Schrödinger and Hamilton-Jacobi equations. A number of new experimental effects have been predicted both for high and low energies. Fine structure constant (1/137) was determined in 1988, masses of numerous elementary particles starting from electron were evaluated in 2007 with accuracy less than 1 % . 2 pentaquarks, θ^+barion, Higgs boson and particle 28 GeV were discovered 11 years later, all of them were evaluated with high accuracy before. The overall picture of the world is based on a unify field. These Equations allow for the beginning of a universe without a Big Bang. Gravity ceases to be a mystery. In principle, a completely new type of "green" energy is possible for mankind.

## Biography

Sapogin Leo Georgy (1936). Full Professor Sapogin now lives in Moscow, Russia. He began in 1954 to study in Taganrog Radio-technical University and graduated (Dept. of solid state physics) in 1959. He served during his military service from 1959 to 1972 at Ministry of Defence as the scientific adviser. Candidate of science (1966). He maintained (1971) the doctor degree in Leningrad State University. In 1972 to 1985, he was the Head of Theoretical Department in Russia Academy of Science. Since 1985 till present he is the Head of Physical

Department of Technical University – MADI. He is the author (or coauthor) of numerous (over 200) published scientific articles, 4 books, school supplies. He obtained (with V.Boichenko), first, very important scientific result: calculating (with accuracy more 0.3%) of the electrical electron charge and of the fine structure constant -1/137. He published (2005) in USA and Russia (together with Prof. Yu.Ryabov and V.Boichenko) the book named "Unitary Quantum Theory and New Source of Energy". Together with Ryabov he calculated mass spectrum of elementary particles and mass bozon Higgs - 131.7 GeV. Full Professor L.Sapogin - academic of Russian Academy of Natural Science and World Academy of Complex Safety. His biography is included in collection books of Who's Who in the World (2006), of International Biographic Centre, Cambridge (2009) and of American Biographical Inst. (2009).



## Lorenzo Bagnasacco

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# Holonomy-Spin Induced Energy Bands Manipulation In Nanowires

## Abstract

We propose a method for inducing coherent band manipulation using a spatially varying Zeeman field. Such inversion is realized by an holonomic transformation that arises from a (non-Abelian) generalization of the Berry phase mechanism. Notably, our approach ensures stability against external perturbations by leveraging an intrinsic topological protection: the unitary transformation is solely dependent on specific boundary conditions of the field, offering robustness without imposing restrictions on the specific variation of the field or its speed of variation. Moreover, our findings  provide a reliable and effective method for coherent spin manipulation in nanodevices.

## Biography

I am Lorenzo Bagnasacco, a third-year Ph.D. student in Nanoscience at the Quantum Information group of the Scuola Normale Superiore in Pisa. Currently, working alongside professors Vittorio Giovannetti and Fabio Taddei, my research focuses on the quantum control of matter states in nanodevices. My fascination with quantum physics dates back to childhood, and now, as I delve deeper into my doctoral thesis, I'm excited to uncover the secrets of the quantum world. Outside of academia, I'm an avid skier and mountain biker, finding solace and inspiration in the natural beauty of the outdoors. Additionally, the discipline instilled by my years of practicing karate has been instrumental in achieving many of my goals. I hold a first DAN black belt in karate, a testament to the dedication and perseverance that this martial art has taught me.

## Maryam Alshahrani

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# New Abundant Analytical Solutions of Coupled Nonlinear Schrödinger (FNSE) Equation in Fractal Order Arising in Quantum Mechanics

## Abstract

In recent years, the nonlinear Schrödinger equation (NLSE) has gained significant attention in both mathematical and physical sciences. Obtaining exact solutions for the NLSE is crucial for understanding various nonlinear physical phenomena in fields such as plasma physics, quantum mechanics, fluid mechanics, electromagnetics, Bose-Einstein condensates, nonlinear acoustics, and nonlinear optics. In this work, we investigate coupled space–time fractional nonlinear Schrödinger equation (FNSE) arising in physics. The FNSE can be utilized to explain non-relativistic quantum mechanical phenomena. With the aid of the conformable fractional derivative (CFD) and fractional complex transform (FCT), we implement the extensive direct algebraic approach (EDAA), the behaviors of some of the generated solutions are shown as 3D-graphics for various with different fractal orders. The optical soliton solutions that are bright periodic, kink bright and kink-bright periodic are among these precise solutions. The acquired results demonstrate the simplicity, effectiveness, and capacity to produce additional kinds of exact solutions of these proposed methods, which are useful in deciphering the intricate physical interpretation of space–time FNSE.

## Biography

I hold a PhD in Electronics Physics from Lancaster University in the United Kingdom. Currently, I serve as the Vice Dean of the College of Science at the University of Bisha in Saudi Arabia. I am passionate about scientific research and education, always striving to contribute to the advancement of knowledge in the field of Electronics Physics. I have published several research papers in various peer-reviewed journals, with more at different stages of publication.

## Muhammad Shoaib Anwar

*Department of Mathematics, University of Jhang, 35200 Jhang, Pakistan*

# Numerical Investigation of Fractional Carreau Hybrid Nanofluid Flow in Magnetized Porous Channels

## Abstract

This study explores the influence of hybrid nanoparticles on heat and mass transfer in porous media, focusing on the effects of convection, magnetic fields, diffusion, radiation, and chemical reactions. A water-based fractional Carreau hybrid nanofluid is utilized to enhance thermal efficiency for industrial applications such as gas turbines and condensers. The fluid flow is modeled using fractional-order derivatives based on the Caputo definition, capturing both integer and non-integer dynamics for a more comprehensive analysis. The governing equations are simplified and solved numerically using the explicit finite difference method (EFD), with stability and convergence criteria ensuring accurate results. Key transport parameters, including the Sherwood number, Nusselt number, and skin friction coefficient, are analyzed to assess thermal and mass transfer behavior. The results reveal that fractional exponents and thermophysical properties significantly impact flow characteristics. An increase in the fractional exponent leads to reduced resistance and higher velocity, while a greater porosity parameter decreases velocity. The temperature gradient is influenced by variations in the fractional exponent and Weissenberg number, affecting thermal transport efficiency. Additionally, the presence of a magnetic field increases skin friction, and improved thermal conductivity enhances temperature profiles. These findings highlight the importance of fractional modeling in accurately predicting heat transfer behavior and optimizing nanofluid applications in industrial processes. By integrating advanced numerical techniques with fractional calculus, this research provides deeper insights into hybrid nanofluid behavior, contributing to the advancement of energy and cooling systems in modern engineering applications.

## Biography

Dr. M. Shoaib Anwar studied Mathematics at the Lahore University of Management Sciences, Pakistan, and obtained his PhD degree in 2019. He then pursued his PhD in Applied Mathematics, focusing on fluid dynamics and heat transfer. Currently, he serves as an Assistant Professor at the University of Jhang, Pakistan. Dr. Anwar has received several academic honors, including recognition among the world's top 2% scientists for 2024. He has published numerous research articles in SCI journals and actively contributes as an editorial board member and reviewer for various international journals. His research interests include mathematical modeling, nanofluids, and fractional differential equations.

## Prof. Xiaoqun Wang

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# Eigenstate properties of the disordered Bose-Hubbard chain

## Abstract

Many-body localization (MBL) of a disordered interacting boson system in one dimension is studied numerically at the filling faction one-half. The von Neumann entanglement entropy SvN is commonly used to detect the MBL phase transition but remains challenging to be directly measured. Based on the U(1) symmetry from the particle number conservation, SvN can be decomposed into the particle number entropy SN and the configuration entropy SC. In light of the tendency that the eigenstate's SC nears zero in the localized phase, we introduce a quantity describing the deviation of SN from the ideal thermalization distribution; finite-size scaling analysis illustrates that it shares the same phase transition point with SvN but displays the better critical exponents. This observation hints that the phase transition to MBL might largely be determined by SN and its fluctuations. Notably, the recent experiments [A. Lukin, et al., Science 364, 256 (2019); J. Léonard, et al., Nat. Phys. 19, 481 (2023)] demonstrated that this deviation can potentially be measured through the SN measurement. Furthermore, our investigations reveal that the thermalized states primarily occupy the low-energy section of the spectrum, as indicated by measures of localization length, gap ratio, and energy density distribution. This low-energy spectrum of the Bose model closely resembles the entire spectrum of the Fermi (or spin XXZ) model, accommodating a transition from the thermalized to the localized states. While, owing to the bosonic statistics, the high-energy spectrum of the model allows the formation of distinct clusters of bosons in the random potential background. We analyze the resulting eigenstate properties and briefly summarize the associated dynamics. To distinguish between the phase regions at the low and high energies, a probing quantity based on the structure of SvN is also devised. Our work highlights the importance of symmetry combined with entanglement in the study of MBL. In this regard, for the disordered Heisenberg XXZ chain, the recent pure eigenvalue analyses in [J. Šuntajs, et al., Phys. Rev. E 102, 062144

(2020)] would appear inadequate, while methods used in [A. Morningstar, et al., Phys. Rev. B 105, 174205 (2022)] that spoil the U(1) symmetry could be misleading.

## Biography

Prof. Xiaoqun Wang obtained his PhD from International School for Advanced Studies (SISSA) in 1992. He is the Xinxing Science Chair Professor and Executive Vice Dean of the School of Physics at Zhejiang University. He has published more than 90 SCI papers.

**Seid Aboulghasem Hosseini**

*Department of Physics, Faculty of Science, Herat University, Herat, Afghanistan*

# Phosphorene: An exceptional gas sensor with selective adsorption and distinctive I-V response for $NH_3$, $CH_4$, and $H_2S$

## Abstract

Recent research on phosphorene synthesis, either single or multilayer, indicates that it has excellent potential for application in small structures. This study used sophisticated computations to examine the adhesion of $CH_4$, $H_2S$, and $NH_3$ molecules to a single layer of phosphorene. This study shows that phosphorene sensors are more effective at detecting certain chemicals than other comparable materials like graphene and MoS2. After determining the optimal locations for these molecules to bind to phosphorene, discovered that the molecule-to-phosphorene charge transfer is essential for phosphorene's high adsorption capacity. Using a particular method, computed the relationship between the drain current and gate voltage for various gas concentrations on phosphorene. The transport properties show significant changes in the armchair direction of phosphorene, which aligns with its unique electronic structure, indicating major changes in current-voltage behavior when gas molecules are added. High sensitivity to gas adsorption of phosphorene of phosphorene, makes it an excellent gas sensor and shows its potential for use in electronic devices. The structural and electronic calculations in this study were performed using density functional theory (DFT) with LDA and GGA approximations. The LDA approximation was used for structural optimization, while the GGA approximation was employed for a more accurate description of intermolecular and van der Waals interactions.

## Biography

I completed elementary, secondary, high school, pre-university, bachelor's and master's courses with the highest grades. And I became the first ranked student in all these academic courses. I won the competitive scholarship of Yazd University for international students from bachelor to doctorate in the field of physics. Now I am an official professor and head of the physics department at Herat university in the Afghanistan. My interests are in theoretical physics, particularly in the fields of quantum gravity, mathematical physics, applied mathematics, and theoretical solid-state physics.

## Tegegne Getachew Legass

*Department of Mathematics, Mekela Amba University, Ethiopia*

# New Lower Bound for the Radius of Analyticity for the Modified 2D Zakharov–Kuznetsov Equation

## Abstract

We consider the initial value problem associated to the 2D modified Zakharov-Kuznetsov equation. For a class of initial data that is real analytic in a strip around the $x$ axis of the complex plane that have a fixed radius of spatial analyticity, we show that the uniform radius of spatial analyticity of solutions at time $t$ is bounded from below by as the time $t$ goes to infinity. This improves very recent works. Our strategy mainly relies on an almost conservation law in a modified Gevrey spaces, local smoothing estimates, maximal function estimates, Strichartz estimates, and Sobolev embedding.

## Biography

Tegegne Getachew Legass received an M.Sc. from the University of Gondar in June 2011 and a Ph.D. from Bahir Dar University by August 1, 2024. He has been at Mekdela Amba University since 2017, and his research interests include applied analysis and mathematical physics, nonlinear partial differential equations arising as models in fluid and plasma dynamics, and Cryptography. Currently, he is a director for the international relations of research and partnerships at Mekdela Amba University. He has published more than eight research papers in reputable journals.

## Vladimir Chigrinov

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

# Azodye photoaligned nanolayers for new liquid crystal devices

## Abstract

Photoalignment and photopatterning has been proposed and studied for a long time [1]. Light is responsible for the delivery of energy as well as phase and polarization information to materials systems. It was shown that photoalignment liquid crystals by azodye nanolayers could provide high quality alignment of molecules in a liquid crystal (LC) cell. Over the past years, a lot of improvements and variations of the photoalignment and photopatterning technology has been made for photonics applications. In particular, the application of this technology to active optical elements in optical signal processing and communications is currently a hot topic in photonics research [2]. Sensors of external electric field, pressure and water and air velocity based on liquid crystal photonics devices can be very helpful for the indicators of the climate change.

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

## Biography

Professor Vladimir G. Chigrinov is Professor of Hong Kong University of Science and

Technology since 1999. He is an Expert in Flat Panel Technology in Russia, recognized by the World Technology Evaluation Centre, 1994, and SID Fellow since 2008. He is an author of 6 books, 31 reviews and book chapters, about 317 journal papers, more than 668 Conference presentations, and 121 patents and patent applications including 36 US patents in the field of liquid crystals since 1974. He got Excellent Research Award of HKUST School of Engineering in 2012. He obtained Gold Medal and The Best Award in the Invention & Innovation Awards 2014 held at the Malaysia Technology Expo (MTE) 2014, which was hosted in Kuala Lumpur, Malaysia, on 20-22 Feb 2014. He is a Member of EU Academy of Sciences (EUAS) since July 2017. He got A Slottow Owaki Prize of SID in 2018 http://www.ee.ust.hk/ece.php/enews/detail/660. He is 2019 Distinguished Fellow of IETI (International Engineering and Technology Institute).
http://www.ieti.net/news/detail.aspx?id=184 http://www.ieti.net/memberships/Fellows.aspx

Since 2018 he works as Professor in the School of Physics and Optoelectronics Engineering in Foshan University, Foshan, China. 2020-2024 Vice President of Fellow of Institute of Data Science and Artificial Intelligence (IDSAI) Since 2021 distinguished Fellow of Institute of Data Science and Artificial Intelligence.

# THANK YOU