Proceedings of 4th ICEST-2024

International Conference on Emerging Science and Technology

March 07 and 08, 2024 Lahore, Pakistan

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Govt. Islamia Graduate College Civil Lines Lahore

International Conference on Emerging Science and Technology

Departments of Physics

Govt. Islamia Graduate College Civil Lines, Lahore.

Govt. Graduate College for Women Wahdat Colony, Lahore.

4th ICEST-2024

Proceedings of papers

Organized by: Departments of Physics, GIGCCL and GGC (W) WC Lahore, Pakistan

March 07 and 08, 2024

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About 4th ICEST-2024

4th ICEST-2024 is a 4th International Conference on Emerging Science and Technology, March 07 and 08, 2024 at Govt. Islamia Graduate College Civil Lines Lahore and Govt. Graduate College for Women Wahdat Colony Lahore, Pakistan. The ultimate ambition of this conference is to bridge the gap between Physics and Emerging Science aiming at technological opportunities for college students and researchers. Advanced technologies promise novel revolutionary products and methods in numerous areas of application. Renowned National and International researchers have been invited as keynote talks at this prestigious conference. Scientists working in research fields related to ICEST-2024 topics are to submit papers. All accepted papers (presented at the conference and following IEEE format) will be submitted and published in the Pakistan Journal of Emerging Science and Technologies (PJEST), Department of Physics, Govt. Islamia Graduate College Civil Lines Lahore, Pakistan.

Venue: Lahore, the eternal city, is one of the oldest cities in the world with a vivid and rich history and culture, records the great changes of the Pakistani nation just like a living history book. Lahore is the capital of the Pakistani province of Punjab and is the country's 2nd largest city after Karachi, as well as the 18th largest city proper in the world. Lahore is one of Pakistan's wealthiest cities with an estimated GDP of $65.14 billion (PPP) as of 2017. Lahore is the largest city and historic cultural centre of the wider Punjab region and is one of Pakistan's most socially liberal, progressive, and cosmopolitan cities.

Message from Organizing Committee

It is our pleasure to have all of you engaged in the International Graduate Physics Conference (ICEST-2024). This International Conference is held in Govt. Islamia Graduate College Civil Lines, Lahore and Govt. Graduate College for Women Wahdat Colony Lahore on March 07 and 08, 2024. This one-day conference focuses on the current research in Emerging Science and related technology. The conference aims to be a key international forum for the exchange and dissemination of technical information in every field of science.

The conference features technical presentations that cover topics of current interest in the area of Plasma Physics, Quantum Entanglement, Organic Framework Nanoparticles: Synthesis and Applications as Cancer biomarkers, trace determination of inorganic/organic analytes, Photocatalysis for Environmental application, simulation, modelling and energy saving. Renowned researchers will give keynote speeches at this prestigious conference.

Therefore, this conference can be considered as an ice breaker for the local and international logistics industry to understand Sri Lanka, South Asia and the Indian Ocean opportunities for more efficient technology-based skilled solutions to be discussed to re-position and invest pragmatically in an emerging region of the world. The world is moving into an emerging science revolution transforming with fifth-generation technologies. We believe staff and students of Govt. Islamia College Civil Lines Lahore will have a great opportunity to learn from the network of renowned researchers and scientists and discuss, and understand how the emerging Science will transform over the next few decades through the discussions and ideas presented at the ICEST-2024. Therefore, it is very necessary that such conference must be carried on annually.

We are pleased to announce that we are launching the Pakistan Journal of Emerging Science and Technologies (PJEST) and selected papers will be published in the Journal. We wish you all enjoy the conference and the wonderful city of Lahore. Please do not hesitate to ask our staff for any queries and assistance.

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Center for Advanced Studies in Physics, GC University Lahore

Title of the talk: Emerging Women's Health and Technology

Prof. Dr. Muhammad Ilyas Khan

Hamad Medical Cooperation HMC Doha Qatar.

Title of the talk: Single Photon Quantum Experiments for Enlightening How we Teach Physics

Prof. Dr Sabieh Anwar

Director, Syed Babar Ali Institute, LUMS, Lahore

Abstract of Accepted Papers

AI BASED DECISION MAKING TO ANALYZE THE REQUIREMENT OF HEMOFILTRATION PROCESS

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Abstract: Artificial intelligence plays a vital role for the implementation of intelligent system for various applications. AI driven system seeks to achieve optimal solution for problems by overcoming the shortcomings of traditional systems. There are many applications of AI based system for biomedical applications. Kidney disease is very common now a days. It affects the ability of body to filter waste products from the blood of the patient. It can be harmful for the production of red blood cells and strength of the bones. Kidneys perform many functions for the body for healthy life. Hemofiltration process is very important to filter waste products from the blood of the patient. This process has many advantages over tradition filtration process.This is very important to recognize the requirement of hemofiltration process when required. Otherwise it can be harmful for the health of the patient. The research work presents the development of AI based system to analyze the requirement of hemofiltration process for the patients with chronic kidney disease. In this work, fuzzy logic based simulation has been performed to investigate the process need. Mamdani model has been used for the implementation of system. Variousinput parameters that reflect the kidney function have been taken into account. Fuzzy inference rules have presented the relationship of input parameters to determine the requirement of process. The output results provide the precise indication to assist in decision making.

The implementation of AI based system for decision making provides anauspicious approach to improve the precision and consistency of hemofiltration requirement for the treatment of patients with chronic kidney failure. This decision-making process can be life saving for patients due to definite indication of required procedure for execution. This system can be helpful to improve the health of patients, resource utilization and decision making of specialists.

Keywords: Artificial Intelligence, Fuzzy logic, Hemofiltration

DESIGN OF A SOLAR SYSTEM-BASED VEHICLE.

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Abstract: A Solar System-based vehicle is a revolutionary response to the current sustainable mobility requirement. Concerns about environmental damage and fossil fuel depletion are driving the search for alternate vehicle energy sources. This study proposes a solar-powered vehicle to solve these problems. Due to climate change and the need to minimize greenhouse gas emissions, a device like this is needed. Fossil-fueled cars increase air pollution and carbon emissions, worsening climate challenges. Solar-powered automobiles reduce environmental effects and use renewable energy. Solar System vehicles are fitted with solar panels to collect solar energy. The electric motor is powered by solar cells that turn sunshine into electricity. This technology might be used in personal mobility, public transit, and business fleets. Its sustainability and efficiency set the Solar System-based vehicle idea apart from previous research and propulsion systems. Solar-powered cars create clean energy on-site, decreasing energy losses during transfer. Solar energy reduces the need for fossil fuels, reducing fuel availability and price volatility. Solar-powered automobiles have several benefits. Zero-emission transportation improves air quality and reduces carbon footprint. Second, solar energy is plentiful and free, providing a constant and renewable energy source for vehicles. Solar-powered cars reduce fossil fuel reliance and price changes by increasing energy autonomy and resilience. An innovative Solar System-based vehicle design offers a possible route to a greener and more sustainable future.

Keywords: Automobiles, Li-ion Battery, Clean Environment, Solar System, Renewable Energy, Zero Emission.

COMPUTER FLUID DYNAMICS SIMULATION OF PHOTOVOLTAIC THERMAL SYSTEMS WITH CUSTOM ABSORBERS TO IDENTIFY TEMPERATURE UNIFORMITY

Muhammad Sufian[1] and Muhammad Javaid Afzal[1]

[1]Government Islamia Graduate College Civil Lines Lahore Pakistan.

Abstract: Modern photovoltaic thermal (PVT) systems integrate PV and thermal collectors to improve energy conversion efficiency. The need for sustainable energy sources has led to their wider acceptance. PVT systems require homogeneous temperature distribution to work well and remain functional for a long. Computer Fluid Dynamics (CFD) simulations, especially with specialized absorbers that improve heat transmission, analyze temperature uniformity in PVT systems. This study examines temperature uniformity in PVT

systems with customized absorbers using ANSYS simulation software, known for its fluid dynamics analytical capabilities. ANSYS's tools describe fluid flow, heat transfer, and radiation in complicated geometries to accurately anticipate temperature distributions under different operating situations. PVT systems use custom absorbers to maximize solar light absorption and heat transmission. This work uses ANSYS simulations to examine the complex relationship between fluid flow patterns, heat transfer processes, and absorber topologies to find PVT module designs that achieve temperature uniformity. This paper's complete approach to PVT temperature uniformity analysis makes it successful. ANSYS simulations provide a more advanced view of PVT system thermal behaviour than simple models or real experiments. This improves temperature forecasts and helps optimize system design and operation. Custom absorbers improve PVT system efficiency and reliability, highlighting the practicality of the results. This work advances PVT technology by revealing that absorber design affects temperature uniformity, which affects renewable energy production and sustainable building integration. This study uses ANSYS simulations and custom absorbers to analyze temperature uniformity in PVT systems and identify significant thermal performance variables. This study helps engineers, academics, and politicians improve renewable energy system effectiveness and reliability with its scientific approach and practical insights.

Keywords: ANSYS Simulation, Custom Absorber, Computer Fluid Dynamics (CFD), Photovoltaic Thermal (PVT), Solar Panel,

DEVELOPING MLP BASED PREDICTION SYSTEM FOR ANTICANCER DRUG RESPONSE USING HYBRID GENOMIC AND CHEMINFORMATICS FEATURES

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Abstract: For a long time, cancer has been treated with a one fits all approach but, with rapid increase in cancer types, this approach has been having diminishing effectiveness. The medical community has endorsed the role of precision medicine for developing effective cancer treatment. Instead of using a one-drug-fits-all approach, healthcare can be customized by adjusting medical decisions, treatments and procedures to a specific patient volume. However, a key issue in precision medicine is the accurate prediction of an individual patient's response to the specialized drug. A large number of machine learning based predictive systems have been developed to predict drug activity using genomic signatures and drug's chemical structure. In this paper, we present Multi-Layer Perceptron (MPL) based anticancer drug response prediction system using hybrid features of genetic expression and drug's chemical structure. The proposed system is developed using famous dataset GDSC (Genomics of Drug sensitivity in Cancer). Our system predicted the lower RMSE value of 1.052 compared to RMSE (1.086) of existing SOTA systems SwNet. It is anticipated that the proposed research would be useful for developing anticancer related targeted drug.

Key Words: MLP; GDSC; Precision Medicine; Gene Expression; SMILES

MAGNETO-OPTICAL KERR EFFECT ACROSS ELECTRODEPOSITED CONISN HALF HEUSLER ALLOY THIN FILM

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Abstract: Half heusler alloys have attracted the attention of the research community owing to its potential applications in spintronic devices. An application-oriented electrodeposition technique is used to prepare CoNiSn thin films. The molarity of the electrolytes is varied as 0.01M, 0.02M, 0.03M, 0.04M & 0.05M by keeping the electrolyte temperature of 50^0C. The prepared thin films are characterized by XRD, VSM, FTIR and MOKE. Mixed phases of CoNiSn-hexagonal and Ni_3Sn_4-hexagonal are observed for the samples having electrolyte molarity ranging from 0.01M to 0.03M. For 0.04M & 0.05M, pure CoNiSn-hexagonal phases are observed. FTIR (Fourier transform infrared spectra) is recorded for the electrodeposited CoNiSn-based half-heuslar alloy thin films with varying molarity ranging from (0.01M-0.05M). FTIR is done in the range of mid IR (300-500 cm^{-1}). FTIR analyzes structural & chemical changes due to different functional- groups. Magnetic analysis of electrodeposited CoNiSn half heuslar alloy thin film shows the soft ferromagnetic behavior for all the samples. Due to the exchange bias phenomenon, the in-plane MOKE loops shift towards the positive x-axis.

INVESTIGATING THE IMPACT OF THE CAPPING AGENT ON THE STRUCTURAL, OPTICAL AND PHOTOLUMINESCENCE PROPERTIES OF $MOSE_2$ QDS

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Abstract: The molybdenum disulfide (MoS_2) is the prominent member of transition metal dichalcogenides (TMDs) due to its variety of practical uses in electronics, energy devices, photocatalysis and sensors. Herein, we report the facile synthesis of $MoSe_2$ QDs via hydrothermal technique by varying capping agent. Using Raman spectroscopy and XRD, the impact of the capping agent on the structural characteristics of the QDs is investigated. Photoluminescence and UV-Vis absorption spectroscopy are used to investigate the optical characteristics of the QDs. The XRD and Raman spectra confirms the formation of $MoSe_2$ Quantum dots. The band gap of the QDs is estimated using Tauc equation. The band gap of the QDs is widened as compare to the bulk band gap of the QDs that confirm the quantum size effect induced by the capping agent. The study state photoluminescence (SSPL) has been studied in detail to prob the luminescent properties of the synthesized QDs.

Key words: $MoSe_2$, TMDs, QDs, SSPL, capping agent

SPECTROSCOPY OF HEAVY MESONS

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Abstract: In the Quark Potential Model, we solve the Schrödinger equation numerically utilizing a shooting method paired with a bisection approach to determine the bound state energies for heavy quark-antiquark pairs. The results provide novel theoretical predictions for the spectroscopy and properties of various heavy meson states, with different quantum numbers. Quantitative results are presented for masses in comparison with the known experimental data. This work helps to expand understanding of heavy meson physics and provides testable predictions for experimental searches and identifications of new undiscovered heavy meson resonances.

Keywords: Potential Model, Schrödinger equation, shooting method, Spectroscopy, Quantum numbers, heavy mesons

COMBINED EFH AND EMIC MODES IN THE HOMOGENEOUS SOLAR WIND PLASMAS.

Zain Ali[1]
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Abstract: When examining the expansion of solar wind into interplanetary space, we observe microinstabilities driven by temperature anisotropies, as evidenced by various spacecraft observations. In the absence of significant heat flux, these microinstabilities appear to regulate and constrain the upper bounds of anisotropies, particularly near 1AU, offering a precise explanation for spacecraft findings. Previous literature has outlined threshold conditions for these unstable modes under different circumstances, establishing an inverse correlation between temperature anisotropy $T_\perp/T_\parallel$ and plasma beta $\beta_\parallel$. These correlations were derived through a combination of linear theory and observational fitting, or through simulations such as PIC methods. In this current study, we employ a macroscopic quasilinear approach, where these correlations naturally emerge, eliminating the need for laborious simulation or linear theory processes. Our focus lies primarily on the electromagnetic ion cyclotron instability driven by excessive perpendicular proton temperature anisotropy ($T_{\perp i} > T_{\parallel i}$), and the electron firehose instability driven by excessive parallel electron temperature anisotropy ($T_{\parallel e} > T_{\perp e}$). Previous studies have overlooked the influence of electrons on the dispersion characteristics of the EMIC mode, as well as the role of protons/ions in shaping the wave spectrum of the EFH instability, assuming both to be thermally isotropic. This work delves into the combined effects of EFH and EMIC instability, thoroughly exploring the dynamic evolution of these combined instabilities and their mutual interaction mediated by particles. Consequently, this research holds promise for advancing the modeling of realistic solar wind model in the future.

A PROACTIVE HEALTH MONITORING APPROACH FOR POST-PANDEMIC ELDERLY CARE

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Abstract: The COVID-19 pandemic has exacerbated the aging-related issues and vulnerabilities faced by the elderly population. The COVID-19 pandemic has led to a rise in social isolation, which has been linked to a potential negative impact on the wellbeing of elderly people. The elderly individuals affected by COVID-19 have encountered prolonged respiratory illnesses. Elderly people have experienced heightened suffering due to their compromised immune systems and precarious health conditions associated with aging.

The proposed system comprises of two modules. The first module determines the location of the person and the second module keeps records and logs of vital signs such as temperature, heart rate, weight, blood pressure, and SpO2. The sensing system we proposed comprises multiple sensors strategically placed in various locations within an experimental area. Monitoring elderly individuals during emergencies can be challenging. To address this concern, we propose a health monitoring system for the elderly, incorporating machine learning algorithms like WKNN (Weighted k-Nearest Neighbor), DT (Decision Tree), SVM (Support Vector Machine) and also compared with ANN (Artificial Neural Networks). Our goal is to leverage vital signs such as heart rate, SpO2, temperature, weight, blood pressure, and other data obtained through smart watches, along with BLE RSSI values, to establish a health monitoring system specifically designed for the elderly.

We utilize WKNN, DT, SVM and ANN for indoor location determination and employ the Apriori algorithm for vital signs analysis. We conducted experiments in various experimental areas to validate both our system and methodologies. The outcomes demonstrate the system's precision in tracking user location within experimental area, and vital signs which can subsequently offer insights into their health status.

Keywords

COVID-19, SpO2, Heart Rate, Temperature, Weight, Blood Pressure, ANN, BLE RSSI, W-KNN, SVM, DT

Fe-DOPED ZnO NANOPARTICLES: USE AS ANTIBACTERIAL SURFACE

Nafeesa Asif[1], Muhammad Tahir[1], Zaheer Hussain Shah[1]
[1]Department of Physics, University of Management and Technology, Lahore

Abstract: The potential of iron Doped zinc oxide nanoparticles in optoelectronics has attracted the attention of the scientific community. An application-oriented hydrothermal approach is used in the synthesis of Fe doped ZnO nanoparticles. This strategy is followed

in order to get the desired results. The preparation of iron (Fe) doped zinc oxide (ZnO) nanoparticles is achieved through the utilization of an application-oriented hydrothermal approach. The concentration of dopant Fe is varied at weight percentages of 1-5wt%. X-ray diffraction (XRD) analysis demonstrates that the hexagonal structure of wurtzite is generated in ZnO across the whole range of dopant concentrations. Increasing the dopant concentration causes a decrease in crystallinity, which in turn reduces the crystallite size value of the nanoparticles. The results of the VSM demonstrate that all of the synthesized samples exhibit soft ferromagnetic behaviour. Normal dispersion behaviour can be seen in both the dielectric constant and the tangent loss. The Cole-Cole plots only show a single semicircle, which indicates that grain boundaries have a strong resistance. The innovative and highly efficient iron-doped zinc oxide NPs (nanoparticles) making them a promising choice for use in hospitals to minimize the bacterial contamination connected with the surfaces that are handled the most in hospitals.

NICKEL FREE NANO-STRUCTURED $Ba_{0.15}Fe_{0.10}Ti_{0.15}Zn_{0.60}$ OXIDE ANODE MATERIAL FOR SOLID OXIDE FUEL CELL: SYNTHESIS & ELECTROCHEMICAL CHARACTERIZATION

Ghazanfar Abbas[1]
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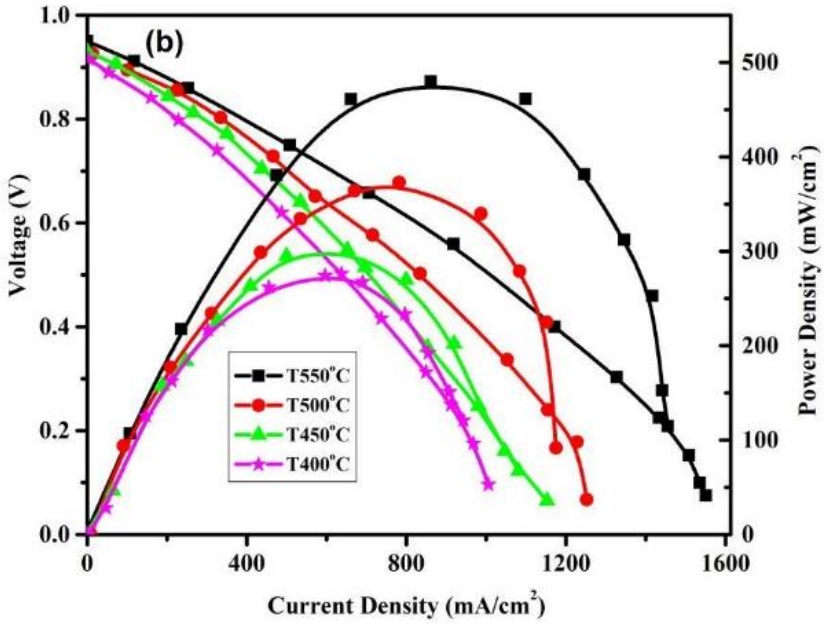
Abstract: High energy consumption rate is creating numerous interest to search out alternative advanced energy conversion technologies. Solid oxide fuel cells (SOFCs) are energy conversion devices with high efficiencies and considered as talented substitute to ease the energy related issues. It is a gadget which changes chemical energy (hydrogen or hydrocarbon fuel) into electricity and power. Conventional solid oxide fuel cell consists of Nickel-Yttrium Stabilized Zirconium (Ni-YSZ) electrodes and Yttrium Stabilized Zirconium (YSZ) electrolyte, shows an excellent power performance at elevated temperature. Lowering the operating temperature, the R&D efforts were modified to investigate the Ni free nano-composite $Ba_{0.15}Fe_{0.10}Ti_{0.15}Zn_{0.60}$ oxides (BFTZ) anode material and has been successively synthesized by wet chemical route. The X-Ray Diffraction technique is employed to analyse the structural characteristics. The magnitude of crystallite size is calculated 39.17 nm from XRD data employing Scherer's equation. SEM technique is approached to observe the surface morphology and noted homogenous distribution. Electrical conductivity was found to be 5.86 and 4.81 S/cm at 600 ^{o}C in hydrogen atmosphere by DC and AC approach respectively. The BFTZ anode is tested in fuel cell with ceria-alkali carbonates calcium doped ceria composite (NKCDC) and sodium carbonated samarium doped ceria (NSDC) electrolytes while BSCF conventional material was used as cathode. The highest performance of BFTZ anode based fuel cell in the term of power density was achieved to be 471 mW/cm^2 at 550 ^{o}C.



DRINKING WATER QUALITY ASSESSMENT

Amir Yaqoob[1], and Jabir Khan Niazi[1]
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Abstract: Access to clean and safe drinking water is essential for public health and well-being. As water resources face increasing threats from pollution, climate change, and population growth, the assessment of drinking water quality becomes paramount. This abstract presents a comprehensive review of methodologies, parameters, and challenges associated with the assessment of drinking water quality. The assessment of drinking water quality involves the analysis of various physical, chemical, and microbiological parameters. Common physical parameters include temperature, color, turbidity, and odor, which can indicate the presence of contaminants or natural variations in water quality. Several methodologies are employed for assessing drinking water quality, ranging from traditional laboratory-based techniques to rapid field tests and remote sensing technologies. Laboratory analysis remains the gold standard for comprehensive water quality assessment, offering high accuracy and sensitivity. However, it is often time-consuming and resource-intensive. Rapid field tests provide quick results but may sacrifice accuracy for speed.

In conclusion, the assessment of drinking water quality is a multifaceted endeavor crucial for safeguarding public health. By employing a combination of advanced methodologies, comprehensive parameter analysis, and interdisciplinary collaboration, stakeholders can effectively manage and protect this vital resource for current and future generations.

Keywords: Drinking water quality, Bacteriological parameters, Public health, Borne disease, Water quality index, Physical-chemical parameters, Bacteriological analysis, World health organization

A QUASILINEAR ANALYSIS OF PROTON FIREHOSE INSTABILITY EXCITED IN MAGNETOSPHERIC COLD AND HOT PROTON PLASMA

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Abstract: In space plasmas including solar wind and earth's magnetosphere, the unstable states of various charged species are regulated through collective and collisional processes. In these dilute plasmas, the stable states of electrons and ions/protons can be determined with the help of microinstabilities that arise from anisotropic particle distribution and heat flow. The purpose of this paper is to emphasize the important function of proton firehose instability in controlling an unchecked increase in these solar wind and magnetospheric regions. If the proton temperature condition of $T_{\parallel p} > T_{\perp p}$ is met, the right-handed circularly polarized proton firehose mode becomes unstable, where the directional subscripts indicate the directions with respect to the ambient magnetic field. Observations and measurements from magnetosphere of earth by magnetospheric multi-scale (MMS) space mission guide us to adopt the bi-Maxwellian nature of the model distribution for the multi-component proton plasma. We also allow the time variations in temperatures of cold/hot proton in order to study the time evolution of the unstable mode. For the selection of the initial conditions associated with observations, we reveal the wave characteristics (growth and unstable wave number range) related with anisotropy in the cold/hot proton temperatures and the plasma betas. We assume different scenarios of initial cold/hot proton temperature anisotropy and plasma betas to highlight the time-scale modifications and saturation of initial bi-Maxwellian distributions, along with resulting wave-energy densities in the context of proton firehose instability.

Keywords: magnetosphere, cold and hot proton components, quasilinear theory

CATALYTIC EFFECT OF ALUMINIUM ON THE STRUCTURAL, OPTICAL, AND ELECTRICAL PROPERTIES OF LASRCRO$_{3-\Delta}$ ANODE

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Abstract: Solid oxide fuel cell is promising conversion technology due to fuel flexibility, higher efficiency, and environment friendly compared to traditional technology. To enhance the efficiency of the device, selection of anode material is important because it affects the electrochemical performance and operating temperature of the cell. In this work, $La_{0.5}Sr_{0.5}Al_xCr_{1-x}O_{3-\delta}$ (x= 0, 0.1, 0.2, 0.3, 0.4) anode has been developed using sol-gel method. XRD analysis exhibited a two-phase structure of the prepared anode, one orthorhombic and second rhombohedral phase with crystalline size in the range 15-18 nm. The surface morphology of the

prepared anode material shows nano-spheres, dumbbells, and platelets. The elemental analysis confirms the presence of Sr, Cr, La, Al, and O in the prepared material. The metal-oxide formation has been confirmed with Fourier Transform Infrared Spectroscopy. The absorption spectra revealed red shift in bandgap 2.85-3.65 eV by increasing the Al concentration. The maximum dc electrical conductivity of the composition anode $La_{0.5}Sr_{0.5}Al_{0.4}Cr_{0.6}O_{3-\delta}$ is found to be 8.01 Scm^{-1} at 600 ℃. The achieved power density of the anode $La_{0.5}Sr_{0.5}Al_{0.4}Cr_{0.6}O_{3-\delta}$ is 69 $mWcm^{-2}$ using hydrogen fuel at 600 ℃.

Keywords: Solid oxide fuel cell, fuel flexible, crystallite size, two-phase structure, elemental analysis, power density

CHARACTERIZATION OF HELIUM PLASMA GENERATED BY PULSED DC GLOW DISCHARGE USING OPTICAL EMISSION SPECTROSCOPY.

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Abstract: Helium plasma has been widely used for the production of active species by mixing in other gases which are used for surface modification of metals. Helium plasma is generated using 100 Hz pulsed DC source and its characterization is carried out by using optical emission spectroscopy. The spectra of helium is recorded at filling pressure (0.5-3.0 mbar), source power (25-150 W) and inter-electrode distance (3-5 cm) using Ocean Optics HR 4000 spectrometer. It is found that production of active species of helium strongly depends on discharge parameters. The emission intensities of He-I (501.3 nm and 667.7 nm) as a function of above parameters are used for the determination of electron temperature. The spectroscopic technique based on the measurement of relative intensities of two spectral lines of the same atom is used to evaluate the electron temperature, which is found to vary from 0.82 eV to 1.89 eV depending on the various discharge parameters. It is found that by increasing the power, the intensity and the electron temperature increases whereas by increasing the pressure, the intensity and the electron temperature decreases. It was also found that the intensity of the species decreases with the increase of the inter-electrode distance.

ANALYSING AND MODELING BRAIN CHANGES DURING AGEING (USING MRI DATA) FOR THE DETECTION OF NEUROLOGICAL DISORDERS

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Abstract: The changes in brain structure and functionality occur with the aging due to the factors such as genetics, neurotransmitters, hormones, and experience. All these changes are associated with functional deterioration and neurodegenerative disease. The volume

of brain shrinks, vasculature, and cognition are mainly affected by brain aging. It is essential to understand that the brain ageing process vary from person to person; hence, techniques for making individualised predictions of brain ageing have been developed (James H.Cole, 2017). Increasingly, research is showing how brain disease or poor physical health negatively impacts brain age. The goal of the project would be to analyses brain imaging data and create a machine learning model of how the brain connections and structure changes during brain ageing. The computational model will help to monitor brain health and diagnose neurological conditions early on, which would be a major help for the ageing society and obesity.

Keywords: brain ageing, neurological disorders, machine learning, brain disea

$Ca_{0.5}Ce_{0.5}Mo_3$ (M = Fe, Mn, Ni) PEROVSKITE NANOMATERIALS FOR HIGH PERFORMANCE ENERGY CONVERSION DEVICES

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Abstract: Ceria-based perovskite nano-composites were used for single layer solid oxide fuel cell (SLFC). Perovskites are a remarkable class of materials with distinctive properties that are favourite among researchers throughout the globe. ABX_3 is the typical chemical form of a perovskite structure. In our model, perovskites with 3d transition metals (Fe, Mn, and Ni) on the B-site and alkaline-earth metals (Ca) and lanthanides (Ce) on the A-site are taken into account for SLFC. The most recent developments and possible uses of perovskite materials for SOFCs are covered in the current study. The co-precipitation approach was used to efficiently synthesise cerium-based $(Ca,Ce)MO_3$ (M=Fe, Mn, Ni) perovskites. Raman spectroscopy, UV-vis spectroscopy, and XRD were employed to thoroughly investigate the elemental compositions and structure of $(Ca,Ce)MO_3$ (M=Fe, Mn, Ni) perovskites. At every temperature, CCMO ($Ca_{0.5}Ce_{0.5}MnO_3$) performed the best out of all the samples. These findings confirm that $(Ca,Ce)MO_3$ (M=Fe, Mn, Ni) performs well for SLFC. The viability of the CCMO application in SLFCs has been confirmed with the peak power density of 874 mW/cm^2 and an OCV of 1.038 V at cell operating temperature of 550 ^oC.

Keywords: Single layer fuel cell (SLFC), Ceria based Perovskite**,** $Ca_{0.5}Ce_{0.5}MO_3$ $(Ca,Ce)MO_3$ (M=Fe, Mn, Ni)**,** Inspiring fuel cell performance

SUPERIOR PERFORMANCE SUPERCAPACITORS: USING HIERARCHICAL HETEROSTRUCTURE COMPOSITE AS THE ELECTRODE MATERIAL

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Abstract: Finding clean, affordable, and sustainable electrical energy is currently humanity's next major challenge. Prioritizing the development of useful energy storage technologies that support the Sustainable Development Goals (SDGs) is essential, even in the face of significant breakthroughs in clean energy generation. Recent studies have focused on complex heterostructured nanomaterials because they perform better electrochemically than single-structured materials. The finding of these novel materials seems to have had a significant positive impact on the development of energy storage devices. These heterostructured nanomaterials have longer cycle lifetimes, higher energy densities, and faster charging rates than traditional materials. The goal of current research is to enhance the composition and structure of these materials for even better performance. In this study, a simple hydrothermal method and in-situ aniline polymerization were used to develop a ternary hybrid electrode material based on metal oxide, carbonaceous, and polymer material. With its high specific capacitance at low current density, great cycle stability, and extraordinary coulombic efficiency, this ternary hybrid electrode material shows promise. Through developments in energy storage technology, this study supports SDGs 7 (Affordable and Sustainable Energy) and 13 (Climate Action) by proposing possible real-world applications in effective and sustainable energy storage systems.

Keywords: ternary composite, electrode, hydrothermal method, electrochemical properties, energy density, hybrid supercapacitor

PHYTOCHEMICAL COMPOSITION OF CHIA SEEDS (SALVIA HISPANICA) BASIL SEEDS (OCIMUM BASILICUM) AND THEIR PHARMACEUTICAL PERSPECTIVES.

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Abstract: Chia seeds and basil seeds are rich sources of phytochemicals, encompassing a spectrum of bioactive compounds. Polyphenols found in both seeds exhibit potent antioxidant properties, which can neutralize free radicals and protect cells from oxidative stress. These seeds also contain flavonoids, contributing to their anti-inflammatory effects by modulating inflammatory pathways. Chia seeds are renowned for their omega-3 fatty acids, specifically alpha-linolenic acid (ALA). Omega-3 fatty acids play a vital role in cardiovascular health and may have neuroprotective effects. Basil seeds, on the other hand, contain compounds with potential antimicrobial, antioxidant, and anti-cancer properties. The objective of this report is to review of current research on phytochemical compositions of chia seeds and basil seeds, along with their pharmaceutical perspectives. This report is based on different research articles that provided insights into the phytochemical and pharmacological aspects of both seeds, emphasizing their diverse therapeutic properties. Further corroborating evidence from PubMed Central, PharmEasy, and other reputable research-based websites.

Keywords: Chia seeds, basil seeds, phytochemical composition, pharmaceutical perspectives, bioactive compounds, polyphenols, flavonoids, omega-3 fatty acids, antioxidants, anti-inflammatory, antimicrobial, anticancer, functional foods.

FROM TRASH TO TREASURE: WASTE-DERIVED NANOPARTICLES

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Abstract: Due to increasing population of our country, the requirements to carry out life processes are also increasing day by day. Due to this every year, we produce a lot of different waste materials. This waste is later burned or enter in our environment in different forms hence creating health related issues. But there is a good news that many of these wastes can be converted to the nanoparticles and these nanoparticles can be used in different applications ranging from daily life uses, agriculture and biomedical fields among others. Presented will be the synthesis, characterization and utilization of nanoparticles prepared specially from expired medicines, egg shells and food-related waste. Antibacterial activity of the prepared nanoparticles will be discussed. This project is a good example of how we can recycle the waste materials, otherwise burned or dumped creating pollution.

Keywords: Nanoparticles, Waste-material, Antibacterial activity, Recycling

NONLINEAR OSCILLATORY BEHAVIOUR OF THE DOUBLY-CLAMPED MICROBEAM TYPE MICROELECTROMECHANICAL SYSTEM

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Abstract: The dynamics of nano/microbeams when used in nano/microelectromechanical systems (N/MEMS) is a key area of research in micromechanics. This is due to nonlinearities appearing in these systems which make them challenging for researchers. The basic aim of this article is to examine the dynamic aspects of the nonlinear oscillation of doubly clamped microbeam. The governing fourth-order partial differential equation is transmuted into a second-order nonlinear ordinary differential equation by employing the Galerkin method and then the Laplace transform-based variational iteration method (LVIM) is practiced to find the approximate analytic frequency-amplitude relationship and the approximate solution of the nonlinear ordinary differential equation for the deflection of microbeam. The whole study is performed for doubly clamped supported boundary conditions. The effect of different parameters such as axial load, electrostatic force, and aspect ratio on the deflection of the beam is examined in detail. The solution obtained from the Laplace transform-based variational iteration method not only exhibits good agreement with observations obtained numerically but also better accuracy yielded when compared to other approximate methods.

INVESTIGATING THE IMPACT OF THE CAPPING AGENT ON THE STRUCTURAL, OPTICAL AND PHOTOLUMINESCENCE PROPERTIES OF $MOSE_2$ QDS

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Abstract: The molybdenum disulfide (MoS_2) is the prominent member of transition metal dichalcogenides (TMDs) due to its variety of practical uses in electronics, energy devices, photocatalysis and sensors. Herein, we report the facile synthesis of $MoSe_2$ QDs via hydrothermal technique by varying capping agent. Using Raman spectroscopy and XRD, the impact of the capping agent on the structural characteristics of the QDs is investigated. Photoluminescence and UV-Vis absorption spectroscopy are used to investigate the optical characteristics of the QDs. The XRD and Raman spectra confirms the formation of $MoSe_2$ Quantum dots. The band gap of the QDs is estimated using Tauc equation. The band gap of the QDs is widened as compare to the bulk band gap of the QDs that confirm the quantum size effect induced by the capping agent. The study state photoluminescence (SSPL) has been studied in detail to prob the luminescent properties of the synthesized QDs.

Key words: $MoSe_2$, TMDs, QDs, SSPL, capping agent

MORPHOLOGICAL AND MOLECULAR CHARACTERIZATION OF GANODERMA LEUCOCONTEXTUM (GANODERMATACEA) FROM PUNJAB, PAKISTAN

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Abstract: Fruiting bodies of polyporous fungi were collected from Murree Hills, Punjab, Pakistan during field visit for the collection of wood inhibiting fungi. These were studied by morphological and molecular basis using the DNA sequences of internal transcribed spacer regions of the nuclear ribosomal RNA gene. The species is found morphologically corresponding to *Ganoderma leucocontextum* and molecular phylogenetic tree supports its position in *G. leucocontextum* clade, thus confirming its identity. Collection of this species is first record from Murree Hills, Punjab, Pakistan.

Keywords: Gymnospermic twigs; ITS region; Phylogeny; Taxonomy

SECONDARY METABOLITES OF PLANTS

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Abstract: Plants are producers of a diverse range of secondary metabolites, which play crucial roles in their defence mechanisms, ecological interactions, and human applications. This paper provides an overview of secondary metabolites in plants, exploring their chemical diversity, biosynthesis pathways, and ecological significance. Understanding these compounds is essential for elucidating plant-environment interactions and potential applications in medicine, agriculture, and industry. Key classes of secondary metabolites discussed include alkaloids, phenolics, terpenoids, and glycosylates, among others. Additionally, the paper examines the ecological roles of secondary metabolites in plant defence against herbivores, pathogens, and abiotic stresses, as well as their allelopathic effects on neighbouring organisms. Furthermore, the therapeutic potential of plant secondary metabolites in traditional medicine and modern drug discovery is highlighted, emphasizing their importance in human health and well-being. Overall, this paper underscores the multifaceted significance of plant secondary metabolites and their implications for ecology, agriculture, and biomedicine.

Keywords: Secondary metabolites, Plants, Alkaloids, Phenolics, Terpenoids, Glycosylates, Biosynthesis, Ecological roles, Plant defence, Medicinal plants, Drug discovery.

WASTE TO CLEAN AND GREEN ENERGY TO COMBAT CLIMATE CRISIS-PATH TO SUSTAINABLE DEVELOPMENT

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Abstract: Most material wastage, climate change, and air pollution are among the top global challenges. In the last 200 years, the atmospheric CO_2 has increased and in the last decades caused severe consequences, particularly increased global temperatures and climate change. CO_2 emissions are the major contributor towards climate issues and are continually increasing. Thus, in order to achieve the "Paris agreement" goal for a negative emission society, there is a need to control such greenhouse gas emissions. There are several technologies that have been introduced to tackle these issues; among these, carbon capture and storage has the potential for significant reductions in emissions and thus great impact. Since the industrial revolution the climate issues especial global warming has been increased because of greenhouse emission which leads to the many concerns all over the world.

The clean energy devices got higher attraction towards scientific research and investigation due environment friendly nature. Among conventional resources energy technologies, these clean energy technologies can considerably decrease the impact of emission to the environment. The development of clean energy is the only way to mitigate the effects of climate change and its unprecedented impacts on society. The development of advanced energy technologies has a big

Achallenge. There are many energy technologies, but research activities on fuel cell technology in Pakistan have been reviewed and it is also discussed how this technology can resolve the current energy crises in Pakistan and can be the source of sustainable energy.

Keywords: Waste, Clean Energy, Recycling, Climate change, Fuel Cells

EXTRACTION, ISOLATION, MODELING AND BIO-EVALUATION OF COMPOUNDS FROM *MORINGA OLIEFERA* LEAVES

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Abstract: Natural extracts are gaining scientific attention due to their phytochemical compositions and enormous medicinal effects. *Moringa Oliefera* (MO) is a plant of medicinal importance due to the presence of several phytochemicals. This study aimed to isolate bioactive compounds present in dry leaves of MO. Different solvent systems were used for the extraction of phytochemicals from MO. Column chromatography was used for the isolation of phytochemicals by the use of silica gel slurry with n-Hexane. Phytochemical analysis and thin layer chromatography techniques were further used for the identification of the isolated compounds. Chem Draw ultra 12.0 was used to draw structures of isolated compounds, afterwards *in silico* studies were carried out by molecular docking software using MOE (Molecular Operating Environment). Molecular docking provided binding energies and ligand-protein interactions between isolated compounds and target protein (PDB id 1T69). This information helped in the prediction of antidiabetic activities of phytochemicals. The binding energy of Laurifolin (a flavonoid), Serpentine (an alkaloid), and Hemlock (a tannin) was found to be -8.24(kJ/mol), -10.22 (kJ/mol) and -7.44(kJ/mol) respectively. In vitro, analysis of phytochemicals was done by α-glucosidase inhibition assay. The isolated compounds showed good antidiabetic potential. Alkaloid showed the maximum percentage inhibition of α-glucosidase at the concentration of 800µg/mL, recorded as 80%. UV/VIS spectroscopy and FTIR spectroscopy were used for the identification of isolated compounds. Phytochemicals, Laurifolin, Serpentine, and Hemlock are proved to be powerful antidiabetic agents. Therefore, these isolated compounds can be used as potential drugs against diabetes.

FACILE FABRICATION OF MULTIFUNCTIONAL TEXTILES USING GREEN SYNTHESIZED NANOPARTICLES

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Abstract: Inspired by the remarkable superhydrophobic (extremely water repellent) behavior of plant surfaces (lotus leaf). Surface morphology and surface chemistry are considered two basic parameters to control the surface wettability.The extract of Emblica officinalis (Amla) leaves was used as reducing and stabilizing agents during the in-situ synthesis

of AgNPs on the fabric surfaces. To lower the surface energy, AgNPs coated fabric was functionalized with 1H, 1H, 2H, 2H-Perfluorooctyltriethyoxyline (PFOTS). To study the surface morphology and surface chemical composition of fabric samples before and after the deposition of AgNPs and PFOTS functionalization, scanning electron microscope (SEM), Fourier Transform Infrared Spectroscopy (FTIR) and energy dispersive X-ray analysis (EDX) were used. The cotton fabric functionalized with PFOTS treatment exhibited 160±1˚ static water CA with a sliding angle of less than 5˚. The untreated cotton fabric shows the CA of less than 10˚ and water was completely absorbed by the fabric within a few mins. The modified fabric showed the wonderful results of self-cleaning and all the dust particles were removed from the superhydrophobic surface as the water droplet rolled down over the surface. The antibacterial activity of functionalized fabric samples against. Gram-negative (Escherichia coli) pathogen was investigated by Kirby–Bauer diffusion susceptibility method. The antibacterial results confirmed the bactericidal effectiveness of the prepared cotton fabric.

Keywords: Superhydrophobic, Antibacterial activity, Cotton fabric, Self-Cleaning

EFFECTS OF GOLD CONTENT ON OPTICAL AND BIOLOGICAL PROPERTIES OF ZnO NANOSTRUCTURES.

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A**bstract:** Gold (Au) doped ZnO nanostructures were synthesized at room temperature by sol gel approach. Nanostructures were annealed at optimized temperature. The properties of Au- ZnO nanostructures were characterized by XRD (X-RAY Diffractometer), Fourier transform infra red spectroscopy (FTIR), Scanning electron microscope (SEM), as well as UV-VIS-NIR spectrophotometery. XRD revealed the hexagonal wurtzite structure of ZnO. The crystallite size was determined to be 25.01nm. The optical characteristics of Au:ZnO nanostructures were inspected through UV-VIS-NIR spectrophotometery. Transparency and changes in the optical band gap were observed in optical studies as the percentage of Au doping increased. The surface morphology and roughness of the nanostructures were affected by the Au doping. By FTIR analysis, the chemical composition of ZnO nanostructures doped with Au was examined. Agar well diffusion was used to test the Au-ZnO antibacterial activity in order to better understand its biological characteristics.

Keywords: Structural properties, Sol–gel, Optical band gap, Structural properties, Au doped ZnO, anti bacterial activity.

PROTON BALLET IN EARTH'S MAGNETOSPHERE: UNVEILING THE ELECTROMAGNETIC ION CYCLOTRON (EMIC) INSTABILITY

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Abstract: The expansion and compression processes in the radially expanding Earth magnetosphere plasma give rise to temperature anisotropy in the charge species, serving as free energy to trigger instabilities. In the sparsely collisional magnetosphere plasma, these spontaneously generated microinstabilities invariably influence particle distributions, defining the states of the Earth magnetosphere below marginal stability conditions. Among various unstable modes, the lefthand electromagnetic proton/ion cyclotron wave is excited when there is a significant perpendicular temperature of protons $T\perp p > T\|P$. Drawing from observations of diverse space missions, we consider magnetosphere protons as bi-Maxwellians with distinct cold and hot components. To capture the time evolution of wave-energy density and proton temperatures, we apply a macroscopic quasilinear theory, incorporating different combinations of temperature anisotropy ratios and plasma betas associated with both cold and hot protons. Our findings, encompassing suprathermal and inhomogeneity effects, hold significance for advancing the comprehension of global kinetic Earth magnetosphere modeling. Keywords: Kinetic theory, linear and quasilinear and earth's magnetosphere

STARK EFFECT STUDY OF POTASSIUM METAL

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Abstract: In this work, I have studied stark effect in potassium metal by inducing a DC field of range 100 V/cm to 2500 V/cm. Rydberg series of three types $ns^2S_{1/2}$, $nd^2D_{5/2}$ and $np^2P_{3/2}$ have been recorded by using atomic beam-setup and Nd: YAG laser (Spectra Physics GCR-II) to excite the dye laser system. In atomic beam channeltron was used to detect ions. Whole system was evacuated in chamber upto 10^{-6} mbar. In such scheme, we stimulated the potassium atom from the $4s\ ^2S_{1/2}$ to state $4p^2P_{3/2}$, with the help of second dye laser, we observed that Rydberg series of potassium. $ns^2S_{1/2}$ and $nd^2D_{5/2}$ have been recorded in the range of 34427.8 cm^{-1}≤E≤34728.4cm^{-1} ($14 \leq n \leq 20$) at the field of 100 V/cm. When we increased the applied electric field, we detected that $np\ ^2P_{3/2}$ series is also induced. These are forbidden lines observed due to coupling in wave functions of different value of orbital quantum no "l" due to applied electric field. We also observed that for higher value of principle quantum number "n", relative peak intensity of $np^2P_{3/2}$ series is higher. Furthermore, observed that at the fields of 15000 V/cm hydrogen like manifolds start appearing, it become more prominent at the fields 2000 V/cm, 2500 V/cm

STUDY ON AEROSOL CLASSIFICATION AND AEROSOL RADIATIVE FORCING OVER ARABIAN PENINSULA USING AERONET

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Abstract: Aerosols are one of the most variable elements of the Earth's atmosphere that have significant impact on the radiative balance and climate of Earth through direct and indirect mechanisms. To understand these effects, quantification of different types of aerosols and their radiative impacts is necessary. Therefore, this study investigates the aerosol type classification, aerosol optical properties, and the resulting aerosol radiative forcing (ARF) from AERONET (AErosol RObotic NETwork) over the Arabian Peninsula for the period 2000-2022. Aerosols are classified into (i) Biomass/Smoke, (ii) Clean, (iii) Desert Dust, (iv) Maritime, (v) Urban, and (vi) Mixed, based on the relationship between Aerosol Optical (AOD 550nm) and Ångstrom̈ Exponent (AE 440-870nm). As per expectations, the seasonal classification of aerosols indicated that mixed and desert dust-type aerosols were dominated by the abundance of mixed-type aerosols at Masdar Institute (50%) and Solar Village (48%) sites. Dust aerosols relatively dominate in Mezaira (25%) and Kuwait University site (42%). Seasonal variations in aerosols radiative forcing (ARF) for all sites show that ARF for the top/bottom of the atmosphere was highest in winter seasons, while ARF within the atmosphere was highest at Solar Village (143.34 Wm^{-2}) and Kuwait University (157.75 Wm^{-2}) site in the autumn season, indicating considerable heating of the atmosphere.

Key Words: Remote Sensing, Aerosol, Radiative Forcing, Environmental Science.

SURFACE MODIFICATION OF CERAMICS BY IONS IMPLANTATION

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Abstract: In the present experiments the changes occurred by the implantation of Ag ion on Sapphire have been studied. Excimer laser of 248 nm wavelength and 50mJ energy with 2000 shots is used to irradiate Ag metal resulting is plasma. Ions from laser plasma are accelerated towards the Sapphire substrate placed at distance of 4 cm from target with biasing voltage of 400V.Changes in the morphology of the surface of ion-implanted ceramics are the examined by scanning electron microscope (SEM) and XRD. Results show that there is crater formation along with collisional sputtering, swelling, spike formation, burning. Blisters and cracks are also observed on the surface of the substrate.

Keywords: Excimer laser, SEM and XRD, Blisters

MACHINE LEARNING APPLICATIONS IN PREDICTING BOND LENGTHS FOR DIATOMIC MOLECULES: A COMPREHENSIVE STUDY ON EFFICIENCY AND ACCURACY

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Abstract: The accurate determination of bond lengths in diatomic molecules is crucial for understanding their chemical properties and reactivity. Traditional quantum mechanical methods, while highly accurate, are computationally expensive and may not be feasible for large-scale studies. In this study, we explore the application of well known machine learning technique (random forest) to predict bond lengths in diatomic molecules, offering a computationally efficient alternative.

We employed a diverse dataset containing information on diatomic molecules which are extracted from materials project website, including their electronic structure and experimentally determined bond lengths. Feature engineering was conducted to extract relevant molecular descriptors, and random forest algorithm was trained and tested on the dataset. The performance of the model was assessed based on their ability to accurately predict bond lengths for diatomic molecules not included in the training set.

Our results demonstrate the efficacy of machine learning in predicting bond lengths with a high degree of accuracy compared to traditional methods. The model exhibits a promising ability to capture complex relationships within molecular structures, providing a valuable tool for rapid and reliable estimation of bond lengths. This approach not only accelerates the calculation process but also opens avenues for studying larger molecular systems and conducting high-throughput screening in material research and drug discovery. The integration of machine learning into bond length predictions offers a synergistic blend of accuracy and efficiency, paving the way for advancements in computational chemistry and materials science.

HIGH-TEMPERATURE SUPERCONDUCTING WAVEGUIDES BASED ON METAMATERIALS

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Abstract: Waveguides are usually consisted of conducting media due to the reflecting properties of conducting surfaces. A perfect electrical conductor is a best reflector of electromagnetic waves. This work is related to the use of high-temperature superconductor in the waveguide walls to analyze the changed behavior of the propagation characteristics of electromagnetic waves. In this connection, a parallel-plate waveguide and a rectangular waveguide, both containing superconducting walls are theoretically analyzed. Electromagnetic waves are allowed to propagate within a metamaterial filled in these waveguides.

The dispersion relation and cut-off wave numbers are analytically obtained and numerically discussed. Some novel characteristics of superconducting waveguides are found which are not present in conventional waveguide structures.

Keywords: Superconducting waveguide, Metamaterial, Filters, Wave propagation.

STREAMING SPATIAL DRIFT INSTABILITY IN QUANTUM PLASMAS

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Abstract: We assume a quantum plasma system consisting upon electrons and ions where electrons are quantized and ions classical. A fluid model is applied for the study of dynamics of such system while including the quantum effects through Fermi pressure, Landau quantization, Bohm potential and exchange correlation potential. The dispersion relation is numerically studied by applying data from the space plasma systems. This work has its applications in laboratories as well as space plasmas.

A FUZZY LOGIC APPROACH FOR OPTIMIZING MICROENVIRONMENTS IN LUNG-ON-CHIP SYSTEMS

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Abstract: Lung-on-Chip (LoC) systems are microfluidic devices holding substantial promise for in vitro drug testing and disease modeling by mimicking the intricate structural and functional features of the human lung. However, replicating the complex and dynamic microenvironment of the lung, encompassing factors like oxygen tension, pH, and inflammatory markers, remains a significant challenge. Conventional control systems often struggle to account for the inherent variability and uncertainty associated with biological systems, leading to inconsistencies in microenvironmental conditions and hindering the accuracy and reliability of LoC models. This study explores the application of fuzzy logic, a computational framework renowned for its ability to handle imprecise and subjective information, to optimize microenvironments within LoC systems. We propose a novel fuzzy logic-based control system that integrates real-time sensor data from the LoC microenvironment, including crucial factors like oxygen tension, pH, and inflammatory markers. This data feeds into the fuzzy logic system, allowing for dynamic adjustments to key control parameters such as flow rates and nutrient concentrations. This adaptive approach aims to achieve a more precise and physiologically relevant microenvironment within the LoC system, potentially leading to the development of in vitro lung models with enhanced predictive capabilities for drug discovery and disease modeling. Furthermore, the research delves into the potential for personalization, integration with advanced LoC features, and the broader implications for drug discovery, disease modeling, and personalized medicine.

A SIMULATION OF ELECTRO HYDRODYNAMIC MICRO PUMPS USING FUZZY LOGIC

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Abstract: Electrohydrodynamic (EHD) micro pumps are essential components in microfluidic systems, offering precise control over fluid flow for various applications, including drug delivery, lab-on-a-chip devices, and microscale cooling systems. However, designing effective control strategies for EHD micro pumps presents challenges due to the complex nonlinear dynamics and uncertainties inherent in microfluidic environments.

In this study, we propose a novel approach for simulating and controlling EHD micro pumps using fuzzy logic. Fuzzy logic provides a robust framework for modeling and controlling nonlinear systems, making it particularly well-suited for addressing the challenges associated with EHD micro pump control.

Through simulation experiments tailored to EHD micro pump applications, we demonstrate the effectiveness of the fuzzy logic-based approach in optimizing pump performance, including flow rate regulation, pressure control, and energy efficiency. By incorporating fuzzy logic into the control strategy, we effectively mitigate the effects of uncertainties such as variations in fluid properties, electrode geometry, and external disturbances.

Our findings suggest that fuzzy logic-based control offers a promising avenue for enhancing the performance and reliability of EHD micro pumps in microfluidic systems. This research contributes to the advancement of microfluidics technology by providing a robust and adaptive control framework that can be applied to various EHD micro pump configurations and operating conditions, ultimately enabling the development of more efficient and versatile microfluidic devices for a wide range of applications.

Keywords: Electrohydrodynamic micropump (EHD), Fuzzy Logic and Microfluidics

UNRAVELING NAEGLERIA: INSIGHTS INTO DIAGNOSTIC, PREVENTIVE AND THERAPEUTIC APPROACHES.

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Abstract: *Naegleria fowleri*, commonly called the “brain eating amoeba”, is a free-living thermophilic flagellate that naturally inhabits warm freshwater bodies. It causes a very rare life-threatening infection known as Primary Amoebic Meningoencephalitis (PAM) with devastating clinical manifestations resulting in a fatality rate of 97% among children and adults globally. The infective trophozoite stage of *N.fowleri* enters the human body while

swimming through the nose; then it traverses the cribriform plate to infect the brain via olfactory nerve ending in severe damage to the central nervous system. The non-specific symptoms of PAM are often misdiagnosed with bacterial meningitis ultimately leading to death of the patient within 3-7 days due to maltreatment and rapid progression of infection. Early diagnosis, quick intervention and innovative therapeutic procedures are crucial in improving the patient's prognosis. At present, antiparasitic and antifungal agents are employed as primary therapeutic options. The current study overcomes the research gaps by exploring latest diagnostic techniques and alternative targeted treatment strategies including the use of combination therapies and immunomodulatory agents to combat the limitations of traditional treatment methods. Recently, advancements in nanotechnology and drug re-purposing have offered promising avenues for improving treatment efficacy. Furthermore, the pathophysiology of *N.fowleri*, its harmful implications on public health and preventive measures are highlighted to prevail over the challenge for Pakistan.

Keywords: Naegleria fowleri, brain eating amoeba, primary amoebic meningoencephalitis, innovative treatment strategies, pathophysiology.

EFFECT OF 300 KEV NICKEL ION BEAM ON STRUCTURAL, MORPHOLOGICAL, AND ELECTRICAL PROPERTIES OF DLC AND AU-DOPED DLC THIN FILMS: A COMPREHENSIVE STUDY FOR OPTOELECTRONIC APPLICATIONS

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Abstract: This research investigates the impact of a 300 keV nickel (Ni) ion beam on the structural, morphological, and electrical characteristics of thin films made of DLC and Au-doped DLC (Au-DLC). Pure and Au-DLC thin films were deposited on a glass substrate using RF magnetron sputtering. Ni ions at a 300 keV energy level were implanted into Au-DLC thin films at exposure rates of 2×10^4 and 4×10^4 atoms/cm^2. XRD results reveal the clustering of Au in DLC, and when Ni ions are implanted at an exposure rate of 2×10^4 atoms/cm^2, both graphite and diamond-like structures emerge. However, with an increased exposure rate of 4×10^4 atoms/cm^2, the film exhibits solely graphite characteristics. SEM analysis illustrates the formation of agglomerations and clusters of Au and Ni in DLC due to the absence of bonding under ordinary conditions in DLC thin films. Four-point probe measurements demonstrate a decrease in the average resistivity of the films due to the doping and implantation of Au and Ni ions, respectively. This study presents a cost-effective exploration of DLC thin films as a conducting layer in various optoelectronic applications, such as serving as a counter electrode in dye-sensitized solar cells.

SMART HEALTH MONITORING SYSTEM USING ARTIFICIAL INTELLIGENCE

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Abstract: Artificial intelligence has revolutionized the healthcare industry. It has changed and improved the processes of detection, diagnosis, treatment and patient monitoring in medical applications. AI based systems and devices have shown an intense impact on personalized healthcare research by providing more precise and efficient outcomes. AI based systems are very efficient in analyzing the huge information. It provides support to medical experts in decision making for the diagnosis and treatment of health issues and monitoring. AI based health condition monitors for the detection of blood glucose, blood pressure, ECG signals and other parameters provide accurate values and timely detection of various health related issues. In this work, a fuzzy logic based health monitoring system has been presented for personalized healthcare monitoring. Simulation has been performed by considering various input parameters to analyze the impact on outcome. Results show that the trends of data with respect to time can provide assistance for controlling the chronic health condition through early detection.

The presented AI based system for personalized healthcare monitoring provides the support for precautionary measurements, timely findings of health condition, and personalized treatment procedures to improve life style of patients.

Keywords: Health Monitoring, Fuzzy Logic, Decision making

SIMULATION OF ELECTRO HYDRODYNAMIC MICRO PUMPS USING FUZZY LOGIC

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Abstract: Electrohydrodynamic (EHD) micro pumps are essential components in microfluidic systems, offering precise control over fluid flow for various applications, including drug delivery, lab-on-a-chip devices, and microscale cooling systems. However, designing effective control strategies for EHD micro pumps presents challenges due to the complex nonlinear dynamics and uncertainties inherent in microfluidic environments.

In this study, we propose a novel approach for simulating and controlling EHD micro pumps using fuzzy logic. Fuzzy logic provides a robust framework for modeling and controlling nonlinear systems, making it particularly well-suited for addressing the challenges associated with EHD micro pump control.

Through simulation experiments tailored to EHD micro pump applications, we demonstrate the effectiveness of the fuzzy logic-based approach in optimizing pump performance, including flow

rate regulation, pressure control, and energy efficiency. By incorporating fuzzy logic into the control strategy, we effectively mitigate the effects of uncertainties such as variations in fluid properties, electrode geometry, and external disturbances.

Our findings suggest that fuzzy logic-based control offers a promising avenue for enhancing the performance and reliability of EHD micro pumps in microfluidic systems. This research contributes to the advancement of microfluidics technology by providing a robust and adaptive control framework that can be applied to various EHD micro pump configurations and operating conditions, ultimately enabling the development of more efficient and versatile microfluidic devices for a wide range of applications.

Keywords: Electrohydrodynamic micropump (EHD), Fuzzy Logic and Microfluidics

ENGINEERING A DNA POLYMERASE FROM PYROBACULUM CALIDIFONTIS FOR IMPROVED ACTIVITY, PROCESSIVITY AND EXTENSION RATE

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Abstract: Positively charged amino acids in the DNA polymerase domain are important for interaction with DNA. Two potential residues in the palm domain of Pca-Pol, a DNA polymerase from Pyrobaculum calidifontis, were identified and mutated to arginine in order to improve the properties of this enzyme. The mutant proteins were heterologously produced in Escherichia coli. Biochemical characterization revealed that there was no significant difference in pH, metal ion, buffer preferences, $3' - 5'$ exonuclease activity and error rate of the wild-type and the mutant enzymes. However, the specific activity, processivity and extension rate of the mutant enzymes increased significantly. Specific activity of one of the mutants (G522R-E555R) was nearly 9-fold higher than that of the wild-type enzyme. These properties make G522R-E555R mutant enzyme a potential candidate for commercial applications.