SPARK 2023 (Symposium on Physics: Advances in Research and Knowledge)

Report of Contributions

Contribution ID: **2** Type: **Oral**

A novel green synthesis route to extract Polyphenol loaded ZnO nanoparticles and their exciting structural and optical properties

A novel green synthesis route to extract Polyphenol loaded ZnO nanoparticles and their exciting structural and optical properties

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Abstract: Zinc oxide (ZnO) is a wide and direct band gap (˜3.37 eV) semiconductor with significant exciton binding energy. Some of its applications include UV detectors, high sensitivity gas sensors, biosensors, solar cells, photoluminescence materials and antibacterial therapy. Due to its exciting properties, one dimensional ZnO nanostructures have been the subject matter of intense research in recent years. The emphasis has been on its extraction from natural sources that outperforms chemical and physical methods in terms of cost, environmental friendliness and ease of scaling up for large-scale synthesis. In this study, we report a novel process to extract nano-sized ZnO particles using Datura metel leaf polyphenolic extract as capping agent.
In a typical reaction, 1M Zinc acetate dihydrate [Zn(CH3COO)2.2H2O] solution is prepared in distilled water and agitated for about 15 minutes. During the stirring process, Datura metel leaf extract is added dropwise to the aforesaid solution. To the above combination, NaOH solution is added until the pH is adjusted to 12. Following addition, the complex mixture is continuously stirred in a magnetic stirrer for another 2 hours and then left undisturbed at room temperature overnight for completion of the reaction. This results in the formation of ZnO nano colloid. The final product is dried for 48 hours in 80℃ using a hot air oven before being ground to fine powder. Figure 1 shows a schematic diagram of the preparation process involved in the synthesis of ZnO nanomaterials.
The production of hexagonal wurtzite structure in ZnO nanocrystallites is confirmed using X-ray diffraction (XRD). The calculated crystallite size from the prominent (101) plane is found to be 33 nm - 26 nm. To further confirm the presence of Zn and O, Energy Dispersive X-ray analysis (EDAX) was performed. The production of ZnO nanoparticles is also revealed from the transmission electron microscopy (TEM) images. Furthermore, Fourier transform infrared spectroscopy (FTIR) is used to identify the various polyphenolic functional groups present in Datura metel leaf extract. The specimens'optical band gaps are determined to be in the range of 3.39-4.10 eV. We aim to evaluate the agro-horticultural applications of the synthesized ZnO nanoparticles as potential antimicrobials against spoilage microorganisms contaminating agricultural goods, which would be significant economically. To the best of our knowledge, this is the first report on synthesis of ZnO from Datura metel leaf extract and therein lies the novelty of this report.

Fig.1. Schematic diagram illustrating the preparation of ZnO nanomaterials from Datura metel leaf extract .

Keywords: ZnO nanomaterials, Polyphenols, Green Synthesis, XRD, TEM, FTIR.
Funding: This study is a part of research project approved by the Department of Biotechnology, Govt. of India (Sanction order No. BT/NER/143/SP44474/2021).

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Session Classification: Technical Session 03

Track Classification: Track 02

Contribution ID: **3** Type: **Oral**

Spectral and temporal properties of GX 17+2 utilizing a simultaneous view from AstroSat and NICER

We report the analysis of the Z-track neutron star (NS) low-mass X-ray binary (LMXB) GX 17+2 using the simultaneous data from the AstroSat (LAXPC/SXT) and NICER mission data. On segmenting the hardness intensity diagram (HID) into three slices—horizontal branch (HB), hard apex (HA), and normal branch (NB)- we investigate the variability of the source and its spectral state evolution throughout the observation. We performed broadband X-ray spectroscopy in a wide energy range utilizing the soft X-ray observation of NICER & SXT/AstroSat and the hard X-ray observation of LAXPC/AstroSat. The source is found to be in a soft state with a photon index > 2 and tends to be in a softer state along the branches. We performed the timing analysis in all the branches separately to probe the presence of aperiodic variability. We determined the photon lag behavior, which is found to follow a hard lag trend. The fractional root mean square variability shows a decreasing variability trend along the branches from HB to NB via HA. We also represent the variation of the spectral parameters like the coronal temperature, photon index, blackbody temperature, and other obtained parameters along the track. Then, we compare the results of the two missions.

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Session Classification: Technical Session 02

Track Classification: Track 01

Contribution ID: **5** Type: **Oral**

Performance analysis of MASnI3 based solar cell with Gold (Au) as back metal contact using 1D-SCAPS simulation program.

Performance analysis of MASnI3 based solar cell with Gold (Au) as back metal contact using 1D-SCAPS simulation program.
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Abstract
In this present work we report a numerical modeling for performance analysis of Methyl ammonium tin iodide (MASnI3) based perovskite solar cells using 1D-SCAPS simulation program. An inorganic compound- Phenyl-C61-butyric acid methyl ester (PCBM) as electron transport material (ETM) and Copper iodide (CuI) as hole transporting material (HTM) are used for simulation study in a p-i-n configuration. The characteristic parameters: short circuit current density, open circuit voltage and the conversion efficiency of the solar cell are determined by varying different input parameters as thickness of absorption layer, working point etc. From the stimulation study, it is seen that Glass / PCBM / MASnI3 / CuI / Au exhibits optimum performance with a Power Conversion Efficiency (PCE) of 25.76 %, Fill Factor (FF) of 77.25 %, a short circuit current density (Jsc) of 34.076796 mA/cm2 and an open circuit voltage (Voc) of 0.9780 V under 300 K temperature.

Keywords: Methyl ammonium tin iodide (MASnI3), Phenyl-C61-butyric acid methyl ester (PCBM), Copper iodide (CuI), Back metal contact (Au), Perovskite solar cells, SCAPS 1D.

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Session Classification: Technical Session 05

Track Classification: Track 04

Contribution ID: **6** Type: **Oral**

Precision Measurement of the Positive Muon Anomalous Magnetic Moment at 0.20 ppm

The muon anomalous magnetic moment, denoted as aμ=(g−2)/2, serves as a crucial low-energy observable, offering an exceptional avenue for precision measurement and computational evaluation. This parameter stands as a rigorous litmus test for the Standard Model (SM) of particle physics and provides a sensitive window into potential new physics beyond the SM framework. Recent concerted efforts have substantially advanced both theoretical predictions and experimental measurements of aμ. On the theoretical front, the Muon g−2 Theory Initiative, a global collaboration of over 100+ physicists, achieved a consensus in 2020 regarding the SM prediction for aμ. Simultaneously, on the experimental side, the E989 Muon g−2 Collaboration at Fermilab (FNAL) unveiled a groundbreaking measurement in April 2021, derived from the Run-1 dataset (2018), boasting an impressive precision of 0.46 ppm, and more recently a more precise result (0.2 ppm) came out which was based on 4-times more data (run-2,3) collected compared to run-1, this result aligns with previous findings from Brookhaven National Laboratory (BNL) as well as with our previous result from 2021. While accentuating the growing discrepancy with the SM prediction, reaching an intriguing 5.0 standard deviations. Here we delve into the experimental configuration and provide a comprehensive update on the ongoing status of the experiment.

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Session Classification: Technical Session 02

Track Classification: Track 01

Contribution ID: **7** Type: **Oral**

Surface alteration of PVA/Coffee nanofibers using oxygen dielectric barrier discharge plasma for the investigation of physical and chemical characteristics

Abstract

Recently, atmospheric dielectric barrier discharge (A-DBD) has gained recognition as a practical technique for modifying the surface properties of polymers. It has the ability to alter the chemical and physical properties of material surfaces at room temperature without any change to their bulk properties. For this study, A-DBD plasma treatment has been carried out on electrospun PVA/Coffee nanofiber mats. These mats are prepared with PVA and Coffee solutions combined in a ratio of 2:3. These as-fabricated nanofiber mats are subjected to DBD plasma treatment in oxygen (O2) gas at atmospheric pressure. The morphology of the prepared nanofiber mat is studied with scanning electron microscope (SEM). Other physical and chemical properties like crystallinity, functionality of the nanofiber mat (before and after plasma treatment) are studied with Powder X-ray Diffraction (P-XRD) technique and ATR-FTIR analysis. Surface characteristics of the mat before and after the plasma treatment are analyzed by Differential Scanning Calorimeter (DSC) and water contact angle measurement. The results indicate that plasma treatment of PVA/Coffee nanofiber mats causes certain enhancement of the produced nanofiber mats' physical and chemical characteristics in comparison to untreated ones. This study may help to understand the effect of A-DBD plasma processing on material surface modification.

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Session Classification: Technical Session 03

Track Classification: Track 02

Contribution ID: **8** Type: **Oral**

Determination of gluon density at small-x using BK evolution theory

Many deep inelastic scattering (DIS) experiments conducted on hadrons by leptons on the experimental site have produced important data on the distribution of partons within hadrons. Theoretical analysis of distribution at the various kinematical regions of small-x (Bjorken's x) and Q^2 of DIS experiments is facilitated by the use of quantum chromodynamics (QCD) evolution equations. The QCD evolution equation that has been extensively investigated in the context of small-x is the Balitsky-Kovchegov (BK) equation. It has been demonstrated at HERA that gluons are the only source of the main contribution in the parton distribution functions (PDFs) of protons at small-x. Hence, understanding the proton's structure requires a thorough examination of the gluon distribution at small-x. We recently presented an analytical solution to the BK equation. In this work, the presented solution is utilised to estimate the gluon distribution or the gluon density at small-x at various x and Q^2 values using the color dipole description of QCD. We present a comparison between our estimated integrated gluon density and the gluon density predicted by the LHAPDF global parameterization groups CT18 and NNPDF3.1sx. Both the HERA and the most current LHC data with highly precise PDF sensitivity measurements are included in the LHAPDF datasets. We also check the behaviour of the gluon density with the variation of color dipole size by plotting the rate of rise of the gluon distribution as a function of x for different color dipole sizes. We found that the rate of rise of gluon density increases with decreasing x for small values of color dipole sizes. The behaviour of gluon distribution at small-x has great implications for phenomenology at the upcoming high-energy hadron-hadron and lepton-hadron colliders.

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Session Classification: Technical Session 02

Track Classification: Track 01

Contribution ID: **9** Type: **Oral**

Choices of scalars on neutrino mass model based on A_4 symmetry.

The neutrino mass models containing different scalars are constructed using $A_4 \times Z_4$ discrete symmetry group. The mass matrices are developed in such a way that they can give necessary deviation from Tribimaximal mixing to generate non-zero θ_{13}. The resultant mass matrices are analyzed and compared to understand the contribution of A_4 singlet scalars to the mass model. In addition, we also try to find the minimal number of scalar fields necessary to construct a neutrino mass model that can reproduce the current oscillation data with good accuracy.

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Session Classification: Technical Session 02

Track Classification: Track 01

Contribution ID: **10** Type: **Oral**

Plasma fireball and dominant instabilities: A brief overview

Plasma fireball and dominant instabilities: A brief overview

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Abstract: An externally biased electrode submerged in a plasma chamber excites a plethora of waves and instabilities [1]. One of the special outcomes of this plasma-electrode interaction is the formation of a bright glow around the centred electrode, termed as plasma fireball (FB), which forms a topic of great research interest of applied value [2]. The plasma FB glows due to the energy release of the excited neutrals through the visible electromagnetic radiation. The neutrals get excited due to their inelastic collision with the field-drifted electrons across the plasma sheath formed around the submerged electrode in the plasma system [3]. The electrons drift in response to the intrinsic electric field across the plasma sheath. The charge-neutral collisions excite the latter almost up to its ionisation potential, which is released subsequently as bright FB glow. The formation and growth of the FB excites a plethora of waves and instabilities across the plasma sheath and double layer around the electrode externally [4]. A brief account of these diverse instabilities, excitation, and damping mechanisms, with panoptic views of their applications in multiple domains of practical importance is summarily presented.

References:

[1] S Dutta, PK Karmakar. Plasma fireball instability. J. Astrophys. Astron. 2022;43(64); 1-8.
[2] RL Stenzel, C Ionita, R Scrittwieser. Dynamics of fireball. Plasma Sources Sci. Technol. 2008;17(035006):1-11.
[3] RL Stenzel, C Ionita, R Scrittwieser. Plasma fireballs. IEEE Trans. Plasma Sci. 2008;36(4):1000-1001.
[4] RL Stenzel, J Gruenwald, C Ionita, R Scrittwieser, JM Urrutia. Sheaths and double layers with instabilities. J. Technol. Space Plasmas. 2021;2(1):70-91.

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Session Classification: Technical Session 03

Track Classification: Track 02

Contribution ID: **11** Type: **Oral**

Promising Materials for Beyond Lithium Ion Based Electrochemical Energy Storage Devices: Exploring The Next Energy Frontier

The ever-increasing demand for energy in day-to-day life thrives the world towards developing highly efficient, powerful energy storage devices. Since its commercialization by SONY in 1991, the lithium-ion batteries (LIBs) have revolutionized the energy sector and been used as a major power source in various portable electronic devices and electric cars. But in light of the concerns like availability, cost, safety of major raw materials like lithium, nickel, cobalt used in the LIBs, the quest for "beyond lithium-ion batteries"such as Zn- ion, K-ion, Na-ion, Al-ion, and proton ion-based devices have intensified. Considering the abundancy, low flammability and its three electron per cation redox electrochemistry leading to its high theoretical capacity, aluminium is gaining widespread popularity in the present-day energy research. The aluminium research primarily focuses on positive aluminium hosting electrode materials and the electrolyte system. Similarly, energy storage devices based on proton (H +) ion can also complement the existing nonlithium based energy storage devices due to the various appealing traits possessed by proton. But the research attempts in developing proper electrode materials have encountered various complications like lower cell discharge voltage, dissolution of the host materials, inadequate cycle life with capacity fading after several cycles. Herein a brief review on various most promising advanced electrode materials for aluminium and proton-based energy storage devices have been demonstrated along with the electrochemistry of a promising electrode material MnWO4 . Various strategies for capacity enhancement are also illustrated here.

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Session Classification: Technical Session 03

Track Classification: Track 02

Contribution ID: **12** Type: **Oral**

Elliptic flow and fluctuation in Au+Au collisions at the STAR-BES energies in the AMPT model.

We study the elliptic flow parameter (v_2) and its event-by-event (e-by-e) fluctuation for the charged hadrons produced in ^{197}Au+^{197}Au collisions at the nucleon-nucleon center of momentum energy $\sqrt{s_{\rm NN}} = 7.7$, 11.5, 19.6, 27.0, 39.0 and 62.4 GeV of the STAR Beam Energy Scan (BES) program. We use A Multiphase Transport (AMPT) model in its string melting (SM) configuration, apply the same kinematic cuts to the simulation as in the experiment, and compare the experiment with the simulation wherever the experimental results are available. The objective is to see to what extent the experiment can be reproduced by the AMPT simulation, and set thereby a reference baseline for the same. We adopt different methods to determine the v_2-parameter, like the participant-plane method $v_2\{P\}$, the event-plane method $v_2\{EP\}$, the two-particle cumulant $v_2\{2\}$ and four-particle cumulant $v_2\{4\}$ methods. Dependence of the v_2 parameter on collision centrality, transverse momentum (p_T), pseudorapidity (η) and $\sqrt{s_{\rm NN}}$ are examined. The auto-correlation effect has been taken care of while determining the centrality of a collision. The issue of non-flow effects arising out of inter-particle correlations is also addressed in the centrality dependence of $v_2\{2\}$ and the same of its e-by-e fluctuation. In the experiment the centrality dependence of the $v_2\{2\}$-parameter based upon two-particle cumulants, is well reproduced by the AMPT-SM at each $\sqrt{s_{\rm NN}}$ considered. In the framework of AMPT-SM, the contribution of non-flow effects is found to be quite small in this regard. However, AMPT-SM can predict the p_T-dependence of v_2 only for very soft hadrons. Beyond $p_T \sim 1$ GeV/c the simulation grossly under predicts the experiment. The simulation also significantly under predicts the η-distribution of v_2 obtained from the event-plane method. We see that the experimental v_2-values marginally increase with increasing $\sqrt{s_{\rm NN}}$, which again is not reflected in the simulation. We also study the centrality dependence of the e-by-e fluctuation of v_2, that of the eccentricity parameter ε_2, and the $\sqrt{s_{\rm NN}}$-dependence of the said fluctuations and their relative fluctuations. Fluctuation in v_2 almost linearly rises with decreasing centrality with a very small gradient. The simulations in this regard reasonably match with the experiment. Non-flow effects do not influence the results significantly. The ε_2-parameter, obtained from the Monte-Carlo Glauber model and using different methods, almost linearly increase with decreasing centrality. It is interesting to note that the v_2-fluctuation linearly scales with the ε_2-fluctuation. Both the v_2-fluctuation and its relative fluctuation non-monotonically depend upon $\sqrt{s_{NN}}$ in the experiment as well as in the simulation. A flattening around $\sqrt{s_{\rm NN}} = 19.6$ and 27.0 GeV indicates some kind of suppression in the v_2-fluctuation, which is another interesting observation. We finally conclude that, while the AMPT-SM can satisfactorily reproduce some of the STAR-BES results on v_2 and its fluctuation, it under estimates the experiment on some other counts. The model therefore requires some fine tuning. It however remains an open question whether the suppression observed in the $\sqrt{s_{NN}}$-dependence of the v_2-fluctuation can be attributed to some critical phenomenon or not.

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Session Classification: Technical Session 02

Track Classification: Track 01

Contribution ID: **13** Type: **Oral**

Numerical analysis of a general Majorana mass texture consistent with latest cosmological bound

The neutrino oscillation parameters are numerically extracted through the diagonalization of a general Majorana neutrino mass matrix whose elements are randomly generated within certain range of allowed values. The allowed values of each element are determined by using the latest neutrino oscillation experimental data within 3σ. The latest Planck upper bound on the sum of three absolute masses, $\sum |m_i| < 0.12$ eV is imposed in the numerical analysis. Both normal and inverted hierarchical mass models satisfy the latest Planck cosmological bound, $\sum |m_i| < 0.12$ eV, showing the possibility of both hierarchies within 3σ. Further, the detailed numerical analysis confirms that normal hierarchical mass model can give upto $\sum |m_i| \geq 0.06$ eV but the inverted hierarchical mass model can give upto $\sum |m_i| \geq 0.1$ eV. In both models, the value of θ_{23} lies below and above 45^0. However, $\theta_{23} > 45^0$ is more favourable for NH whereas $\theta_{23} < 45^0$ is more favourable for IH.

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Session Classification: Technical Session 02

Track Classification: Track 01

Contribution ID: **15** Type: **Poster**

Δ(54) flavor model for Majorana neutrinos: Double Inverse Seesaw

We formulate and discuss the neutrino mass matrices for the present neutrino oscillation data. The matrices are discussed numerically in the framework of the $\Delta(54)$ flavor model with the double inverse seesaw mechanism for Majorana neutrinos. We introduced Vector like (VL) fermions which are all Standard Model gauge singlets. We use extra symmetry to constrain the unwanted terms in our Lagrangian. The exact tribimaximal neutrino mixing pattern undergoes a deviation as a result of the incorporation of extra flavons, leading to the emergence of a non-zero reactor angle θ_{13}. We tried to discuss all the neutrino oscillation parameters in terms of our model parameters and it agrees with the latest global fit to neutrino data.

Keywords—Majorana neutrinos, Double inverse seesaw, Vector like fermions, Mass matrices

References

[1] Chuli´a, S.C., Srivastava, R. and Vicente, A., 2021. The inverse seesaw family: Dirac and Majorana. Journal
of High Energy Physics, 2021(3), pp.1-29.
[2] Bora, H., Francis, N.K., Barman, A. and Thapa, B., 2023. Neutrino Mass Model in the Context of
Δ(54) ⊗ Z2 ⊗ Z3 ⊗ Z4 Flavor Symmetries with Inverse Seesaw Mechanism. arXiv preprint arXiv:2305.08963.
[3] Ishimori, H., Kobayashi, T., Ohki, H., Shimizu, Y., Okada, H. and Tanimoto, M., 2010. Non-Abelian discrete
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Session Classification: Technical Session 02

Track Classification: Track 01

Contribution ID: **16** Type: **Poster**

Study of Ion Density Profile in Compact-IECF Device in the Presence of External Magnetic Field

The need for a small scale portable neutron source is always immense. The inertial electrostatic confinement (IEC) device is one such device which uses electric field to produce neutron through D-D or D-T fusion [1,2]. In CPP-IPR the maiden IECF device uses deuterium plasma to produce neutron in the order of 10ˆ7 n/s in triple grid cylindrical geometry [3]. The electric field produced due to the high negative voltage applied to the cathode accelerates the deuterium ions to gain energy which can overcome the coulomb barrier and thereby fuse to form neutron as one of the by-product of nuclear reaction [4]. To further increase the neutron production rate (NPR) a small cylindrical geometry IEC device is fabricated and is wrapped with thick copper wire around the device to produce an external magnetic field which will confine the charge particles mainly electron and thus will increase the ion density inside the device. The I-V characteristics of the plasma created inside the device is studied using Langmuir probe diagnostics. The ion density increases when we apply an external magnetic field in comparison whereas it remains the same when no external magnetic field is present. Also the confinement of electrons is more prominent and distinct and gets more narrow as we increase the field strength.

References:
[1] G. H. Miley and S. K. Murali, Inertial electrostatic confinement (IEC) fusion, Fundamentals and Applications,(Springer, 2014).
[2] R. L. Hirsch, Inertial-Electrostatic Confinement of ionized fusion gases, J. Appl. Phys. 38 (1967) 4522-4534.
[3] Saikia, L., Bhattacharjee, D., Mohanty, S. R., & Adhikari, S. (2023). Studies on ion flow dynamics in a disk shaped inertial electrostatic confinement fusion device under the influence of a triple grid arrangement. Physics of Plasmas, 30(2)
[4] N. Buzarbaruah, N. J. Dutta, J. K. Bhardwaz and S. R. Mohanty, Design of a linear neutron source, Fusion Engineering and Design, 90, 97-104 (2015)

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Session Classification: Technical Session 05

Track Classification: Track 04

Contribution ID: **17** Type: **Oral**

Space Geodetic investigation of temporal mass variations within the Earth's system

The Earth system is composed of the atmosphere, hydrosphere, geosphere, and biosphere. The mass of the Earth system remains constant, however, there is a redistribution of mass between the compartments. This mass redistribution gets perturbed by the variations in the precipitations induced by climate change. The surface of the Earth responds elastically to these mass variations and it can be detected by space geodetic techniques like Global Navigational Satellite Systems (GNSS) and Gravity Recovery and Climate Experiment (GRACE)/GRACE-Follow On (FO).
In this study, the deformations of the Earth's surface caused by temporal mass variations have been investigated. The area of Northern India has been considered for this particular investigation.
The results are analyzed and discussed.

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Session Classification: Technical Session 05

Track Classification: Track 04

Contribution ID: **18** Type: **Oral**

Topology of black hole Thermodynamics in Horava Lifshitz Gravity

In this work, we study the thermodynamic topology of a superfluid black hole solution in Horava gravity known as the Horava Lifshitz (HL) black hole in canonical ensemble. This exotic black hole solution belongs to a special class of of black holes whose thermodynamics exhibit a line of (continuous) second order phase transitions known as λ phase transitions akin to those observed in the superfluidity of liquid ^4He. We consider the Horava Lifshitz (HL) black hole as topological defects in their thermodynamic space and investigate its local and global topology by computing the winding numbers at those defects. We work with both 4 and 5 dimensional black hole solutions. We find that the topological charge of both the 4D and 5D black hole solutions is equal to 1. Hence, we infer that they belong to the same topological class.

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Session Classification: Technical Session 02

Track Classification: Track 01

Contribution ID: **19** Type: **Oral**

Comprehensive analysis of the ionospheric response to the 2015 geomagnetic storms over different station

Abstract:
A crucial and fundamental problem in ionospheric physics is the ionosphere's dependency on solar activity. This dependence provides information that is necessary to comprehend the ionosphere's changes and its processes. Here in this work, ionospheric electron densities and fof2 is utilized to characterize large-scale ionosphere responses during 2015 geomagnetic storm. With the data gathered from International Reference Ionosphere (IRI-2016 model), which is an empirical standard model of the Ionosphere, this work try to construct a correspondence between the solar activity and the change in Ionosphere's characteristics across three different stations, on different altitudes. It has been observed that the electron density decreases on the day of the solar event as compared to the normal quiet days. Similar decrease in fof2 can also be seen for the three different stations on the geomagnetic storm day. Geomagnetic storms are linked to both the suppression and amplification of abnormalities. At low and middle latitudes, extreme events may result in overshielding, PPEF, and fluctuating electric fields, especially if magnetospheric ring current plasma is augmented in a way that encourages such effects.
Keywords: Geomagnetic storm, TEC, foF2, International Reference Ionosphere (IRI)

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Session Classification: Technical Session 05

Track Classification: Track 04

Contribution ID: **20** Type: **Oral**

Variational M_{W_R} dependence of leptogenesis studied in minimal left-right symmetric model.

In this work, the Left-Right Symmetric Model (LRSM) has been realized with the modular group of level 3, that is, $\Gamma(3)$ and weight 2, which is isomorphic to non-abelian discrete symmetry group A_4. As, it is a well known fact there are physics beyond the Standard Model framework, where several phenomenological studies can be carried out. In our present work, we are concerned about the study of leptogenesis (resonant leptogenesis) in LRSM, at different $SU(2)_R$ breaking scales. The advantage of using modular symmetry is that, we do not need to use any extra particles (flavons) for obtaining the desired results within the realization of the model. In the present work, we have considered different values of mass of the right-handed gauge boson namely 3.5,5,10 and 18 TeV to study leptogenesis. It has been observed that the results are well within the bounds set by the experiments which suggests that the study of leptogenesis via $\Gamma(3)$ modular realization can prove to be a consistent theory and would help us in further phenomenology herefafter.

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Session Classification: Technical Session 02

Track Classification: Track 01

Contribution ID: **21** Type: **Oral**

Propagation of UHE cosmic rays in the light of f(R) gravity power-law model

While the origins of ultra-high energy (UHE) cosmic rays remain shrouded in uncertainty, several important milestones have been reached in recent years in the experimental study of cosmic rays with energy above 10^{18} eV. Within the vast expanse of intergalactic space, turbulent magnetic fields (TMFs) are believed to pervade, and these fields could exert a significant influence on the journey of UHECRs across the expanding Universe, which is currently undergoing acceleration. Thus, it is imperative to incorporate these considerations into our theoretical framework to gain a deeper understanding of the empirical observations related to UHECRs. In light of this, our research delves into the impact of UHE particle diffusion in the presence of TMFs, all within the context of the f(R) gravity power-law model. f(R) gravity is a type of modified gravity theory that generalizes Einstein's general relativity by replacing the Ricci scalar R with an arbitrary function f(R) in the geometric part of the action. Based on the f(R) gravity power-law model, we explore the diffusive behavior of UHECR protons, particularly focusing on their density enhancement throughout their propagation. We found that the f(R) gravity model considered here plays an effective role in the propagation of CRs and the results have lain within the required range. This research endeavor seeks to shed light on the intricate interplay between cosmic rays, magnetic fields, and gravity theories, contributing to a more comprehensive understanding of the fascinating realm of UHECRs.

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Session Classification: Technical Session 02

Track Classification: Track 01

Contribution ID: **22** Type: **Oral**

Phase space analysis of LRS-BI metric in f(Q) gravity theory

Isotropy and homogeneity are the two assumptions on which the standard cosmology stands. However, some observational deviations from the standard cosmological predictions have made the researchers more interested in anisotropic cosmological models. Locally rotationally symmetric Bianchi type I (LRS-BI) metric is one of the simplest yet prominent candidates to study the anisotropic characteristics of the Universe. Further, the failure to get the observational evidence of dark energy (DE) and dark matter (DM) has made researchers look for other alternate gravity theories. The recent development of symmetric teleparallel theory equivalent to GR (STEGR) and its extension $f(Q)$ theory have provided ample opportunity for researchers to study cosmological problems in a more refined way. In this work, we have considered the $f(Q) = -(Q+2\Lambda)$ model to study the phase space in the LRS-BI Universe to determine the system's stability along with the nature of the critical points. Here Λ represents the cosmological constant. Our study found that the LRS-BI metric in $f(Q)$ theory shows the distinct phases of the Universe like radiation-dominated, matter-dominated, and dark energy-dominated eras as predicted by standard cosmology with minor deviations.

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Session Classification: Technical Session 02

Track Classification: Track 01

Contribution ID: **23** Type: **Oral**

Nuclear symmetry energy slope and its impact on exotic magnetized matter

In this study, we investigate the influence of the nuclear symmetry energy slope on the equation of state (EoS) of dense matter with Δ-admixed exotic matter in neutron stars and its consequences for neutron star (NS) observable properties such as mass-radius
relationships and tidal responses. The equation of state is formulated within the framework of covariant density functional theory, incorporating coupling schemes that involve nonlinear and density-dependent models [1] while accommodating the existence of non-nucleonic degrees of freedom in heavier systems. The slope of the symmetry energy parameter (Lsym) is adjusted based on the density-dependent behavior of isovector meson coupling to baryons. Our findings indicate that lower values of Lsym at saturation promote the early emergence of Δ-resonances relative to hyperons, resulting in a higher threshold for the latter at increased densities of matter [2]. Consequently, this influences the threshold densities at which nucleonic direct Urca processes occur, thereby impacting the cooling mechanisms of neutron stars. Additionally, due to the significant high NS surface magnetic fields we also investigate the impact of strong magnetic fields on the exotic matter and found that the strong magnetic fields influences the (anti)kaons to delay its appearance ultimately stiffening the EoS [3].

References:
[1] Yang, J. and Piekarewicz, J., Annual Review of Nuclear and Particle Science 70, 21 (2020)
[2] Thapa, V. B. and Sinha, M., Physical Review C 105, 015802 (2022)
[3] Kundu, D., Thapa, V. B. and Sinha, M., Physical Review C 107, 035807 (2023)

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Session Classification: Technical Session 02

Track Classification: Track 01

Contribution ID: **24** Type: **Oral**

Characterization of Atmospheric Boundary Layer over Dibrugarh, using Pisharoty sonde and ceilometer

Abstract

The atmospheric boundary layer (ABL) is the lower part of the atmosphere, which is in continuous interaction with Earth's surface due to friction and heating or cooling. The ABL extends upward from the surface to a height that ranges from 100-3000m. The ABL is often turbulent, with a strong diurnal cycle of temperature, wind, and other factors, particularly over land and ice (Holtslag et al 2013). Over land, it varies greatly over the day, but at sea, the depth of the ABL is often a few hundred meters and rather stable over the course of a day. The study of ABL dynamics is essential for a better knowledge of the structures, characteristics, and processes under various geographical climatic and atmospheric conditions for better parameterization, as well as the interchange of ABL and free troposphere. The present study is carried out in Dibrugarh University (27.4ºN, 94.8ºE, 111m above mean sea level), Dibrugarh, a semi-urban area in eastern Assam, a state in north east India (NEI). Pisharoty sonde (a Radiosonde) was used for collecting upper-air meteorological observations during 2016 -2018. The use of Automatic Lidars and Ceilometers (ALC) is expanding beyond cloud base height monitoring to include the study of atmospheric boundary layer (ABL) dynamics. Present study also employed an all-weather ground-based ceilometer CL31 LIDAR with very high temporal and vertical resolution to constantly monitor the ABL over Dibrugarh beginning in April 2023. Pisharoty sonde retrieved, seasonal ABL height is maximum during pre-monsoon (1123±216 m) and minimum during winter (816±110 m). The Pisharoty sonde retrieved meteorological profiles are further used to derive perceptible water vapor (PWV), that varies between 0.7 cm - 2.6 cm during daytime and at night PWV varies from 0.7 cm to 2.85 cm. Ceilometer derived ABL ranges from 1.5 km - 2 km Further, these ground based measurements will be used to validate reanalysis data set retrieved ABLs.

Keywords: Atmospheric boundary layer, Pisharoty sonde, Ceilometer

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Session Classification: Technical Session 05

Track Classification: Track 04

Contribution ID: **25** Type: **Oral**

Design, development and implementation of an Android application based battery tester for USB powered devices

In this work, we proposed a method to design, develop and implement an Android application based battery tester for USB based system, such as: smart phones, tablets, or other USB powered devices to evaluate its performance. In the proposed method, a shunt resistor of known value is selected. The output of the USB powered devices is applied to the resistor through its USB port. The voltage drop across the resistor is a function of current flowing through it. Hence, based on the known value of voltage and current, battery power and capacity is evaluated. A low power, 16-bit precision analog to digital converter ADS1115 is used to convert the analog output of the resistor to digital format. Further, ESP32 microcontroller is used to process, evaluate the parameters of USB powered devices, and transmit the data through Bluetooth. The Android application running on the mobile, developed on MIT App inventor, connected to ESP32 through Bluetooth is used for data visualization and analysis. The observations are displayed on LCD, interfaced to ESP32 as well as in the Android application running on the mobile phone. The results of various tests on the system will be discussed in this paper.

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Session Classification: Technical Session 04

Track Classification: Track 03

Contribution ID: **26** Type: **Oral**

Complex permittivity and permeability characterization of Expanded graphite- Fe_3O_4-White Cement based magneto-dielectric nanocomposite for X band microwave absorption

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Abstract:
Anechoic chamber used for testing of microwave absorption of devices basically designed by incorporating absorbing materials on the walls of a concrete structure. In this present investigation, a cement based composite embedded with expanded graphite and Fe_3O_4 filler has been characterized for complex permittivity and permeability in the frequency range 8.2 to 12.4 GHz by using Nicolson and Ross method employing Agilent 85071E material measurement software. Initially, Fe_3O_4 filler materials were synthesized by co-precipitation method and mixed with Expanded Graphite (EG) and White Cement in different wt. % and characterize for microwave properties in the frequency range. SEM chacterization for Fe_3O_4 particle found to be of size 30 nm. The complex permittivityε_r and permeability 〖(μ〗 _r) values showed an increasing trend with increases in filler wt. % with maximum ε_r=18-j10and 〖(μ〗 _r=1.5-j0.35) for 40 wt. % composition which indicates its suitability for application in preparing walls of Anechoic chamber.
Keywords: Complex permittivity and permeability, expanded graphite, Ferrite
References:
[1] Celzard A., Marechˆe, J. F., Furdin, G. and Puricelli, S. Electrical conductivity of anisotropic expanded graphite-based monoliths, J. Phys. D: Appl. Phys 33, 3094-3101, 2000
[2] Cullity, B. D. Elements of X-ray diffraction, Addison Wesley, Massachusetts, 1978.
[3] Oikonomou, A., Giannakopoulou, T., and Litsardakis, G. Design, fabrication and characterization of hexagonal ferrite multi-layer microwave absorber, Journal of Magnetism and Magnetic Materials 316(2), e827–e830, 2007

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Session Classification: Technical Session 03

Track Classification: Track 02

Contribution ID: **27** Type: **Poster**

The role of oxygen in deposition gas on optical properties of radio frequency sputtered nanocrystalline (Mg0.95Zn0.05)TiO3 thin films

Nanocrystalline (Mg0.95Zn0.05)TiO3 thin films were deposited on to quartz and Pt/TiO2/SiO2/Si substrates by radio-frequency reactive magnetron sputtering. The (Mg0.95Zn0.05)TiO3 sputtering target was prepared by solid state reaction method. The effect of deposition gas ratio i.e. ratio of oxygen and argon (O2/Ar) on structural and optical properties of (Mg0.95Zn0.05)TiO3 thin films were investigated. The optical properties of the films were calculated using the optical transmittance spectra. The Wemple-DiDomenico single oscillator model is used to understand the dispersion phenomenon of the refractive index of the (Mg0.95Zn0.05)TiO3 thin films. Significant variations in the optical and dielectric properties of the films are observed with the O2/Ar ratios. The Urbach energy was calculated for all the films deposited on to quartz substrates and found to decrease with an increase in O2 content in O2/Ar ratio. Furthermore, the observed optical properties and wettability of the thin films are promising for optoelectronic applications.

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Session Classification: Technical Session 03

Track Classification: Track 02

Contribution ID: **28** Type: **Oral**

Neutrino masses in left-right asymmetric model

This paper present a comprehensive investigation into the construction of a neutrino mass model utilizing the $\Gamma(3)$ modular group, which exhibits an isomorphism with the A_4 symmetric group. The study focuses on developing a left-right asymmetric model by incorporating modular symmetry. An advantageous aspect of employing modular symmetry in our model is the elimination of need for additional particles, known as "flavons". Our study investigates the impact of modular symmetry on neutrinoless double beta decay($0\nu\beta\beta$) by considering both standard and non-standard contributions to the effective mass calculation. Additionally, we investigate the impact of the non-unitary matrix on CP-violation using modular symmetry.

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Session Classification: Technical Session 02

Track Classification: Track 01

Contribution ID: **29** Type: **Oral**

Neutrino masses, mixings and leptogenesis using A_4 modular symmetry

We have studied neutrino masses and mixings by adding a scalar triplet η to the particle content of minimal inverse seesaw. In order to realize this extension of minimal inverse seesaw we implement an isomorphic modular group $\Gamma(3)$ and a non-abelian discrete symmetry group A_4. The use of modular symmetry in our work helps us to reduce the number of flavons. We have also used Z_3 symmetry group in our work. We find that a sufficient parameter space for both the hierarchies is found to lie within the allowed range as given by various experiments and observations. In order to examine the validity of our model with various experimental constraints, we have calculated neutrino masses and mixings, baryogenesis via leptogenesis. Finally, we find that the model is successful in producing the neutrino parameters in the 3σ range.

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Session Classification: Technical Session 02

Track Classification: Track 01

Contribution ID: **30** Type: **Oral**

Upper and Lower Atmosphere interaction during Tropical Cyclones

Tropical Cyclones (TCs) are one of the most significant weather phenomena in the Earth's lower atmosphere that causes a variety of damages and large scale destruction to lives and property due to violent winds, heavy rain (torrential rainfall) and storm surges. TCs, also referred to as hurricanes in the Atlantic Ocean and eastern Pacific Ocean and typhoons in the western Pacific, is a low pressure system which is caused by atmospheric disturbances over the tropical ocean with a sea surface temperature (SST) greater than 26℃. Technically they are defined as an intense low pressure system with organized convection that originates over tropical or subtropical waters circulating either anti-clockwise (in the northern hemisphere) or clockwise (in the southern hemisphere). Bay of Bengal (BoB) is one of the most vulnerable regions for the development of some of the strongest and deadliest tropical cyclones. India and Bangladesh are the highly affected countries by BoB cyclones which occur usually during pre-monsoon (April and May) and post-monsoon (October to November) seasons. Because of its unique geo-climatic conditions and densely populated coastal region, the Indian subcontinent is considered to be the worst affected area of the world with regard to TCs.

The favorable conditions for TC formation include six major parameters, three dynamical: low-level relative vorticity, coriolis parameter and tropospheric vertical wind shear, and three thermodynamics: sea surface temperature, conditional instability, and mid tropospheric relative humidity. These parameters are analysed to examine the effect of four different types of cyclones: Super cyclonic storm - Gonu (1st June, 2007 to 8th June, 2007), Extremely severe cyclonic storm - Hudhud (7th October, 2014 to 14th October, 2014), Severe cyclonic storm - Mora (28th May, 2017 to 31st May, 2017) and Very severe cyclonic storm - Ockhi (29th November, 2017 to 4th December, 2017). In this study the International GPS Service (IGS) scintillation data at 15-min interval is taken from website ftp://cddis.gsfc. nasa.gov/pub/gps/data/daily/ for the locations on the tracks of the cyclones. To validate the observation from ground receiver (bottomside) the TEC data from SWARM satellite (topmside) is also investigated. The tropospheric parameters data is extracted from Giovanni Model (Merra-2).

The noticeable variations in wind speed, potential vorticity, relative humidity and outgoing long wave radiations in the troposphere have been observed during all the four cyclones. For the upper atmosphere, day to day vertical TEC (Total Electron Content) over the locations along the path of the cyclones is evaluated, which exhibit significant variations. The upward propagating waves from lower atmosphere carry energy and momentum capable of affecting the TEC dynamics. Anomalous depression in VTEC is noticed during the landfall of the cyclone (12th October to 14th October, 2014) under the geomagnetic quiet condition (Dst ≤ ±50). The decrease in VTEC might be the result of combined effect of TC-inspired gravity waves, ejection of neutral particles from the terminator of TC, and lightning electric fields that redistribute the chemical constituents of the ionosphere by increasing the number of neutral particles at different ionospheric heights. These upper and lower atmospheric responses during pre cyclonic and cyclonic periods can be an added parameter to be used in forecasting cyclones.

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Session Classification: Technical Session 05

Track Classification: Track 04

Contribution ID: **31** Type: **Oral**

A study on Daily Temperature Forecasting of North East India Region using Machine Learning models

Conventionally, numerical weather prediction models are used for the prediction of weather conditions worldwide. However, these models are not affordable for everyone due to their high-end hardware requirements. Nowadays, machine learning models are being used in various fields of Earth and atmospheric sciences including classification of remote sensing images, land use land cover, change detection, weather forecasting, detection and prediction of weather extremes, etc. because of the fact that they are data-driven, scalable, customizable and can be deployed on any devices. In this work, we are using different machine learning models for daily mean temperature forecasting. We are using time series remote sensing data for training and testing of the models. We have evaluated the regression models with different evaluation metrics such as RMSE, MAE, and R2 on the dataset. We have compared the results of the evaluation metrics to find the model giving the best predictions.

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Session Classification: Technical Session 04

Track Classification: Track 03

Contribution ID: **32** Type: **Oral**

Impact of Higher Order QED Correction on the Thermodynamic Topology of Euler-Heisenberg Ads Black Hole

Our presentation is based on the thermodynamic topology of the Euler-Heisenberg-AdS black hole and the higher-order Euler-Heisenberg-AdS black hole. This investigation is carried out by considering the generalized off-shell free energy approach, where black holes are conceptualized as defects in the thermodynamic space. Our study adopts the newly introduced residue method for this purpose. Our primary focus revolved around scrutinizing the influence of varying thermodynamic parameters on the thermodynamic topology of these two black hole systems. For the Euler-Heisenberg-AdS black hole, the topological class differs based on the Euler-Heisenberg parameter, denoted as a. Specifically, the topological numbers are found to be W = + 1 for a < 0 and W = 0 for a >0. Remarkably, these topological numbers remained constant irrespective of changes in the thermodynamic parameters. In case of the higher-order Euler- Heisenberg-AdS black hole, the topological class remains same for both negative and positive values of a at a fixed β, which emerges due to higher-order quantum electrodynamics (QED) corrections. The topological number W is found to be +1, which remains same regardless of the change in the thermodynamic parameters. Hence, the introduction of the parameter β had a clear impact on the thermodynamic topology of the Euler-Heisenberg-AdS black hole.

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Session Classification: Technical Session 02

Track Classification: Track 01

Contribution ID: **33** Type: **Oral**

HomeSafe: A Programmable Real-Time Surveillance System for Home Application

Safety and security of personal assets has become a critical concerns in today's society. This calls for the development of sophisticated and efficient surveillance systems [1, 2]. With the advent of technology and Internet of Things, faster and low-cost computing hardware with high performance sensors and multi-camera units enables the design and implementation of real time monitoring systems [3, 4, 5]. This study presents the design and implementation of a real time surveillance system built on Raspberry Pi platform incorporating legacy devices. The system employs Passive Infrared Sensor (PIR) sensors interfaced with raspberry pi that detects motion and triggers the capture of images by multiple cameras of any intrusion. The system also generates alerts and sends them to a remote user in case of unauthorized intrusion, providing a comprehensive solution for real-time surveillance. This approach provides a low cost and effective solution for securing homes, public spaces, and critical areas.

Keywords: Surveillance, raspberry pi, motion sensor, motion detection.

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Session Classification: Technical Session 04

Track Classification: Track 03

Contribution ID: **34** Type: **Oral**

QoS Aspects of Loosely Couple Microservices for Solar PV Power Estimation

Deployment of Computational physics through the paradigm of loosely coupled microservices can play a vital role for parallel computing that can be utilized for estimation of solar PV power. As such we propose to deploy a novel model that can be used to perform different computational logic for the domain of physics. We call this model as MicroComPhy (Microservice for Computational Physics). As a prototype deployment we use three mathematical equations for (a) current generation, (b) measurement of junction thermal voltage and (c) Nominal operating cell temperature (NOCT) measurement, which are required for the estimation of solar photovoltaic power generation. The parallel computing through the design pattern of microservice architecture is evaluated through development and deployment of Spring boot application with Apache Tomcat server. The quality of the service is evaluated through the metrics of response time, throughput and hits/s. The correlation of quality metrics is observed. The experimental setup, the quality observation and the statistical analysis will be discussed. It can be concluded that quality metrics for computational physics are stable while executing the parallel computing using microservice architecture.

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Session Classification: Technical Session 04

Track Classification: Track 03

Contribution ID: **35** Type: **Oral**

Ammonia gas sensing by undoped and Copper doped tin oxide nanoparticles: A spectroscopic approach using Raman Spectroscopy as sensing tooll

SnO_2, a n-type metal oxide semiconductor with a wide band gap of 3.6 eV has emerged as a potent gas sensing material. The gas sensing properties of SnO_2 can be further enhanced by doping it with foreign metals, noble elements and metal oxides in addition to reducing it to nanometer size. In this work we have studied the gas sensing performance of tin oxide by reducing it to nanometer scale and doping it with Cu. Further we have used Raman Spectroscopy as the sensing tool, instead of the conventional electrical method. Due to the band bending phenomenon in SnO_2, a charge depleted region is developed at the conduction band leading to decrease in conductivity. If this surface is exposed to reducing gases like CO or H_2, they would react with the ionosorbed oxygen and donate electrons to the conduction band, thus replenishing the otherwise charge depleted region of the conduction band. This results in the increase of conduction of the sensor. We had proceeded on the basis of the fact that due to this replenishment of charges, there would be a change in shape, size or orientation in the electron cloud when the surface of the sensor is exposed NH_3, another reducing gas. This change would produce a change in the polarizability ellipsoid and that would be reflected as an intensity variation of the classical Raman modes which was observed in our study.

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Session Classification: Technical Session 03

Track Classification: Track 02

Contribution ID: **36** Type: **Oral**

Design of fast settling SFA and ALLF controlled 4th order Phase locked loop using Simulink

Analysis of phase lock loop (PLL) using Simulink is an efficient method. Designing a PLL on a chip is a tedious process as it requires a lot of sums to fabricate it and consume months of time for development. Hence, we need another alternative to know whether the design will work or not and so Simulink is the preferred choice. SIMULINK provides a platform for graphical editing of blocks, managing them, libraries for predefined models and simulation of complex systems and rectification if required. We use such advantages of SIMULINK for deep analysis of PLL. Here, we discuss, analyse, design and discover uses of PLL using SIMULINK. In this work, we focus on designing a 4th order PLL using basic foundation blocks such as phase detector (PD), active loop filters such as: active -Standard Feedback Approach (SFA) and Active Lead-Lag Filter (ALLF) and voltage-controlled oscillator (VCO). Further we simulate and analyse certain criteria's such as settling time (ST), loop bandwidth (BW) and phase margin (PM) for checking performance of the PLL. The fastest ST for SFA controlled PLL and ALLF controlled PLL is observed to be 0.431nS and 1.32nS respectively. As such, the SFA controlled PLL provides faster ST and consequently faster acquisition with an improvement of 67.34% over ALLF controlled PLL. Also, both the systems result in improved stability in terms of PM. We have found out the output of VCO, PD, SFA and ALLF in simulink of the PLL model which provides essential response and hence improves the dynamic characteristics of both the system.

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Session Classification: Technical Session 04

Track Classification: Track 03

Contribution ID: **37** Type: **Oral**

Impact of defect state in the structural, electronic and spectroscopic properties of graphene quantum dot by substituting heavy elements on the surface

Quantum dots are nanostructured semiconductor materials whose dimension is comparable to the de Broglie wavelength of free electrons. Due to the quantum confinement effect, the motion of the electrons present in the quantum dots is restricted in all three dimensions and the electronic energy states become quantized as compared to their bulk counterparts. This quantization of energy states gives rise to significant changes in the electronic properties of the material. Here, in this work, we have designed graphene quantum dots and studied their electronic and spectroscopic properties. In addition to that we have also introduced a defect state in the graphene surface by introducing heavy elements in its lattice structure. The density functional theory (DFT) is applied to design, optimize (in the gas phase), and investigate the impact of the defect state in the graphene surface, which is the most widely used electronic structure method in the material science community (the significant importance of DFT in physics and chemistry is evidenced by the 1998 award of the Nobel Prize). Results obtained from the present investigation signify that the incorporation of heavy elements not only produces structural distortion but also has the capability to induce lattice defects on the graphene surface. This deformation occurs due to the difference in electronegativities and covalent radii of the heavy elements and the carbon. Furthermore, we have noticed some additional energy states that appear near the fermi energy level as a result of the creation of the defect states. These energy levels significantly impact the density of states, orbital coupling, overall conductivity etc. of the graphene quantum dots.

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Session Classification: Technical Session 03

Track Classification: Track 02

Contribution ID: **38** Type: **Oral**

Cost Minimization of Fuel Cell through the Application of Indigenous Graphite: An Approach

Fuel cells are projecting as beneficial energy conversion device and popular among researchers as ecofriendly, cost effective with high output alternative to traditional fuel. The component bipolar plates (BPs) in fuel cell unit distribute gases (H2 and O2), prevent gas leakage and guide the flow of electricity and heat within the stack. Sustainability of BP is determined by working efficiency in medium of pH 2-3, heat management upto 100°C (in PEMFCs) and shock tolerant within cell environment. Overall efficiency, volume, weight, cost of fuel cell and its possibilities of commercialization highly controlled by quality of BP. Different category graphite (Natural, synthetic and heat treated) procured from indigenous developer and their composite preparation can be done to achieve the properties as set by USDOE 2025 for BP. It is expected that use of indigenous graphite composite and qualitative study for BP may open novel and wider prospect in relevant research domain.

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Session Classification: Technical Session 03

Track Classification: Track 02

Contribution ID: **40** Type: **Oral**

Development of polymer based flexible Piezoelectric nanogenerators for tactile sensing application

In today's IOT based world, tactile sensors play a vital role in providing information arising from physical interaction with surrounding environment. Amongst various types of tactile sensors, piezoelectric nanogenerator based sensors are quite effective owing to their efficient performance under any small external stimuli. Especially polymer based flexible piezoelectric nanogenerators are useful for integration to human body and thus have gained a significant attention. In this work we present the development of PVDF-HFP based flexible nanogenerator for tactile sensing application. The PVDF-HFP polymer has been developed
using simple chemical technique and the flexible sensor devices have been achieved upon integrating Aluminum substrates over the polymer films. The fabricated devices were responsive towards biomechanical imparts like finger tapping, hand clapping etc. and showed a maximum open circuit voltage 43.64V and 0.15μA of short circuit current. Further upon attachment of such five sensors to a common nitrile gloves, distinguishable signals were recorded upon holding surrounding objects. Finally, the signals generated out of such gloves were successfully transferred to a mobile device of an end user via Bluetooth module. Further optimization of such nanogenerator can lead to the fabrication of prototype wearable components for efficient tactile sensing and transmission to a remote location.
Keywords: Polymer, nanogenerator, piezoelectric, sensing

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Session Classification: Technical Session 03

Track Classification: Track 02

Contribution ID: **41** Type: **Poster**

Metal Semiconductor Nanocomposite for Plasmonic Solar Cell

The growing world energy demands, limited fossil fuel resources, as well as considerations based on greenhouse gas emissions, are motivating the search for viable renewable energy sources. Among the possibilities, solar energy conversion is of great interest because it is globally available, inexhaustible, and electrical energy can be converted to other energy currencies such as hydrogen. Solar cell is a several decades old research area continuing for the quest of harvesting solar energy and efforts in this field has made solar cells commercially available although the efficiency is still very less. Colloidal nanocrystal based organic solar cells are envisaged to be a cost effective alternative to conventional inorganic cells. The photo-emission and absorption of semiconductor nanocrystals is tunable by the size as a result of quantum confinement effects. To increase the efficiency, solar cells with semiconductor nanocrystals and conducting polymer have been devised but this approach has two shortcomings: firstly, a surfactant must be used to control nanocrystal size and shape. Some of the surfactant gets incorporated into the final nanocrystal and conjugated polymer mix, which inhibits efficient charge transfer. Secondly, the mixing approach requires the use of co-solvents, which can adversely effects nanocrystal solubility and polymer chain orientation. Although the organic composite yielded few promising result in efficiency, the power generated by per square meter solar panel to its production cost is still high owing to less efficiency of the materials. Also the stability issues of the organic materials is a big challenge for effective large scale application of such organic composite solar cells and hence still the inorganic materials are in practical application. The efficiency of the solar cells studied largely hindered by the scattering loss of solar radiation which effectively reduces the absorption of the photons by the active materials. The scattering from metal nanoparticles near their localized plasmon resonance is a promising way of increasing the light absorption in thin-film solar cells. Few reports of higher efficient solar cells used a very thin/nanoparticles layer of metal. Light incident on the metal surface gets scattered by the metal layer and thus increases the absorbance which ultimately yield better efficiency. The improved absorption on the active materials layer alone can improve the efficiency of the solar cells by manifolds. Application of very thin (˜1nm) metal layer on semiconductor nanoparticles can achieve the highest absorbance of the visible spectrum of solar energy if the size of the composite can be tuned to perfection. Our research is focused on synthesis of such semiconductor/metal hetero nanostructure and their size control to perfection to achieve the highest absorbance which will ultimately lead to highly efficient solar cell.

In this paper we report synthesis of semiconductor /metal core shell (CdS/Ag) nanocomposite structure. The samples are characterized by X-ray diffraction (XRD), Uv-vis absorption spectroscopy, transmission electron microscopy (TEM) I-V characteristics under dark and light current. The high current under illumination in CdS/Ag nanostructure indicates the applicability of such structure in solar energy harvesting.

Keywords: solar cell, nanocomposite, Plasmon, core shell structure

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Session Classification: Technical Session 03

Track Classification: Track 02

Contribution ID: **42** Type: **Oral**

z- Domain Analysis for Discrete Time 3rd Order Phase - Locked Loop

Abstract—A discrete time z –domain high frequency phase –locked loop model is presented in this paper. The z –domain transfer functions of the proposed system is derived by using impulse invariant technique to achieve an overall behavioral performance of the system. A second order active standard feedback approach filter is used in the loop to investigate the stability of the system. The stability margins in terms of phase margin, gain margin, overshoot, damping ratio are simulated by deriving the closed loop transfer function of the system in z –domain approach. The simulation results indicates that higher the value of phase margin enhance the stability of the system with no peak in the frequency response curve. Also, it is observed that lower the values of gamma represent that the system is unstable.
Index Terms—Damping ratio, gain margin, overshoot, phase margin, stability, transfer function

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Session Classification: Technical Session 04

Track Classification: Track 03

Contribution ID: **43** Type: **Oral**

Highly sensitive and selective label free immunosensor based on GO/PEDOT-PSS decorated with AuNPs for precise detection of Mycotoxin

We have explored spherical AuNPs anchored GO modified PEDOT-PSS based bioelectrode for sensing mycotoxin (especially, Aflatoxin B1). Synthesis of PEDOT-PSS over ITO electrode was carried out by adapting simple electrochemical polymerization technique in presence of GO as dopant. Further, uniform distribution of AuNPs on the surface of GO/PEDOT-PSS/ITO electrode was achieved by electrochemical layer-by-layer deposition method. Using glutaraldehyde as a covalent linker, the mouse IgG antibody was covalently immobilized over the surface of the prepared electrode. Structural and morphological characterization of the synthesized electrodes were carried out through XRD and FESEM; respectively. Electrochemical characterization, namely Cyclic Voltammetry and Impedance spectroscopy were employed to investigate electroactive properties after each process steps of sensor fabrication. Using single frequency capacitance transient measurements at 77 Hz and 1 kHz, different concentrations of analyte (anti-Aflatoxin B1 derived from mouse) interaction with antibody were monitored. The proposed immunosensor exhibited high selectivity with a response of 8.3125 nF ng-1mL within the concentration range of 18.18 to 300 ng mL-1 at 77 Hz and 1.2038 nF ng-1mL within the range 18.18-291.42 ng mL-1 at 1 kHz towards detection of Aflatoxin B1. The respective LODs were estimated to be, 67.8 ng mL-1 (452 pM), and 62.5 ng mL-1 (416 pM) at 77 Hz and 1 kHz. Adoption of electrochemical sensor design can offer a fast, reliable, and efficient strategy for sensing mycotoxins in specific food items (peanut, maize, mushroom etc.) prior human consumption.

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Session Classification: Technical Session 03

Track Classification: Track 02

Contribution ID: **44** Type: **Poster**

Shadows of Renormalisation Group Improved Black Holes Surrounded by Plasma

The study of black hole shadows after the discovery of the M87 black hole by the Event Horizon Telescope (EHT) has gained major interest recently. In this work, we have studied the shadows of a renormalization group improved (RGI) black hole system surrounded by two types of plasma media, viz *homogeneous* and *inhomogeneous* plasma. We have found that the associated free parameter ξ related to the momentum cutoff scale plays a significant role in determining the photon sphere radius and hence the black hole shadows.

Keywords: Black Hole Shadows, Renormalisation Group (RG), Plasma

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Session Classification: Technical Session 05

Track Classification: Track 04

Contribution ID: **45** Type: **Oral**

Cloud Characterization over Dibrugarh using a LiDAR

Clouds occur both horizontally and vertically and are one of the most significant atmospheric constituents which play a vital role in the alteration of meteorological phenomena in a region. They can alter the climate by trapping the emitted longwave radiation from the earth, which warms the environment or by reflecting back the incoming solar radiation into space, cooling the atmosphere. Dibrugarh (27.47°N, 94.91°E, 111 m amsl), one of the northeastern locations in India is known for its varied weather conditions due to the topography, proximity to huge water bodies and the Himalayan region. Clouds are found in abundance in this region and thus there arises a necessity to study its behaviour pertaining to its effect on the climate. Although cloud studies are available in this region using satellite data, the in-situ observation is limited. Vaisala Ceilometer CL31 is one such remote sensing in-situ instrument which is being used to measure cloud base height at three cloud bases over Dibrugarh. The updraft and the downdraft of the cloud layers have also been observed with this instrument on some particular days. Besides these, the precipitation events can also be identified. The measured CBHs are used further to validate Sentinel-5P NRTI satellite observation.

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Session Classification: Technical Session 05

Track Classification: Track 04

Contribution ID: **46** Type: **Oral**

DESIGN OF A COMPACT, HANDHELD MICROSCOPIC IMAGING SYSTEM BASED ON AN AFFORDABLE SoC PLATFORM

Optical microscopy is widely regarded as the preferred imaging technology in the broad domains of healthcare, biology, and other different fields of application. It is a powerful tool that enables the visualisation and investigation of the complex and dynamic characteristics inherent in the cellular and sub-cellular structures of various specimens. However, despite its extensive utilisation and numerous benefits, a conventional laboratory optical microscope is subject to certain significant limitations. Their bulkiness, cost, fragility, and need for skilled personnel to operate them limit their usability within well-established and advanced laboratory facility conditions. All these factors make it challenging to use such microscopes as point-of-care tools in resource-limited regions and sectors. So, an alternative approach must be taken to tackle these issues and drawbacks and make biomedical optical imaging more accessible and affordable in all regions. In that regard, this work reports the design and development of a compact, cost-effective, and robust microscopic imaging platform based on the ESP32 System on Chip (SoC) development board with the camera module. The compact optical setup that houses all the required optical and electronic components was designed with the help of 3D CAD software and fabricated using 3D printing technology. The developed imaging system, based on the ESP32 SoC platform, can be accessed wirelessly on any device, such as a smartphone or a computer. This system utilizes the ESP32 camera module attached to easily available electronics and optical parts to perform bright-field imaging of the samples. A programmable 0.95-inch organic light-emitting diode (OLED) display with 96x64 pixel resolution was used as an optical source to develop the system. The designed platform was able to generate a magnification of about 2.16x with a measured lateral resolution of 2.19 μm while imaging the 1951 USAF resolution test target. The performance of the device was demonstrated through imaging of standard microbeads, nerve cells, human epithelial cheek cells, and other samples. The total cost of the complete imaging system is around $48 (around Rs. 4000), making it a very pocket-friendly and efficient imaging system.

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Session Classification: Technical Session 04

Track Classification: Track 03

Contribution ID: **47** Type: **Oral**

Design of Low Cost Optically Transparent Antenna for WiMAX applications

Electronic devices that are optically transparent have sparked a lot of curiosity. Many new applications for transparent electronics are being developed in a wide range of industries, including displays, glasses, solar panels, terrestrial and satellite communications, integrated circuits, and sensors, where optical transparency is necessary for the covert placement of electronic devices on surfaces. Due to the emergence of novel materials and fabrication techniques over the past few years, there have been substantial improvements made in the creation of transparent wireless electronics. Transparent antennas are among the most popular transparent electronic devices because of their numerous uses in the Internet of Things (IoTs), smart cities, the healthcare industry, security, and other industries. This article focuses on the design of a low cost transparent antenna using a thin Conductive PET film extracted from a thrown away computer keyboard circuit layout. CST student version is used for carrying out the simulation of the antenna design for obtaining its return loss and radiation pattern performances. For the best antenna prototype a return loss of -29.76 dB at 5.26 GHz has been achieved via simulation and broadside radiation patterns are obtained for both the principal planes of the antenna.

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Session Classification: Technical Session 04

Track Classification: Track 03

Contribution ID: **48** Type: **Poster**

Banana peel derived Carbon Quantum Dots for Degradation of Methylene Blue

Abstract: In this work, carbon quantum dots (CQDs) were synthesized from banana peels using a cost-effective green hydrothermal method. The CQDs were characterized using UV-Vis and PL spectroscopy. UV-visible spectrophotometric investigations confirmed the presence of carbon dots showing two absorption peaks at ˜252 nm and ˜282 nm. The CQDs exhibit blue luminescence when exposed to ultraviolet light. Furthermore, the photocatalytic activity of the prepared CQDs was examined in the degradation of the organic dye methylene blue (MB).

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Session Classification: Technical Session 03

Track Classification: Track 02

Contribution ID: **49** Type: **Oral**

Design and testing of integrated IOT & AI based smart systems for real-time monitoring of environmental parameters of different locations and physiological parameters of people during movements.

ABSTRACT: The project aims to develop an integrated IoT and AI-based smart system for real-time monitoring of environmental and physiological parameters while moving on the road from location to destination. Monitoring of parameters such as pollutants material present in the air, oxygen level, air quality and physiological metrics like heartbeat, blood oxygen level of the person concerned using non-invasive technology; this system empowers users to make informed decisions for their well-being and safety on the go. It bridges the gap between environmental awareness and personal health, offering actionable insights through a user-friendly interface. Significance of the project lies in advancing scientific knowledge and its potential for socio-economic impact including environmental resource conservation and improved outdoor experiences.

Keywords: IoT and AI, smart system, pollutant material, non-invasive, Environmental resource conservation

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Session Classification: Technical Session 04

Track Classification: Track 03

Contribution ID: **50** Type: **Oral**

TRIBOELECTRIC NANOGENERATOR BASED FLEXIBLE SENSOR FOR MONITORING SWEATING CONDITION AND BODY TEMPERATURE

The conversion of mechanical energy into electrical energy through the triboelectric nanogenerator (TENG) which works on the principle of triboelectrification and charge induction, is one of the methods to harvest mechanical energy from our surroundings and biomechanical movements. The external stimuli like pressure, humidity, sweat, temperature, etc can affect the output performance of a TENG, which opens up the path for TENG as a real-time sensing application. Here we report a ZnO and ZnO/g-C3N4 based single-electrode triboelectric nanogenerator (STENG) for the sweat and temperature sensing applications respectively. For sweat sensing applications the STENG has been fabricated by using ZnO nanorod grown on a textile platform. The sensing capability of the fabricated STENG has been observed with the variation of saline water. It is observed that with the variation of the amount of saline water, the output of the fabricated STENG has been changed. The increment of output voltage due to the variation of the amount of saline water is expected due to the attachment of hydrated Cl present in saline water with ZnO. Further, the prototype of STENG has been operated upon by attaching it to a human body under biomechanical body movement. The fabricated STENG offers a limit of detection of 4.65 μL with a sensitivity of 0.016 V/μL. Similarly, ZnO/g-C3N4-based STENG has been fabricated on commercial Al substrate for temperature sensing applications. It is observed that the output voltage of the fabricated STENG varies due to the temperature variation, which signifies the applicability of the STENG as a temperature sensor. Next, for the real-time monitoring of human body temperature, the fabricated STENG has been operated under biomechanical foot movement by attaching it to a shoe insole. The fabricated STENG for temperature sensing applications offers a sensitivity of 0.18 V/OC. Finally, the wireless transmission of the data in a smartphone through a microcontroller has been demonstrated.

Keywords: Nanogenerator, ZnO, ZnO/g-C3N4, sensors.

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Session Classification: Technical Session 03

Track Classification: Track 02

Contribution ID: **51** Type: **Poster**

Photocatalytic degradation of Methylene Blue Dye using Tea leaf-assisted Gold Nanoparticles

Abstract: Plants and their extracts play a crucial role in the green synthesis of nanoparticles because of their environmental friendliness. In this work, an efficient hydrothermal approach was used to synthesize gold nanoparticles (GNps) using tea leaf extract. The GNps were characterized using UV-Vis and PL spectroscopy. UV-visible spectrophotometric investigations confirmed the presence of gold nanoparticles showing absorption peaks at ˜533.8 nm. The photocatalytic activity of the prepared GNps was examined in the degradation of the organic dye methylene blue (MB).

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Session Classification: Technical Session 03

Track Classification: Track 02

Contribution ID: **52** Type: **Poster**

Biocompatible Functionalization of Semiconductor Quantum Dots towards Drug Delivery: A brief review

In today's world, the quest of multitasking ability of nanoparticles, especially quantum dots (QDs), is profoundly envisioned due to their analogousness with the atoms/molecules leading to the generation of discrete energy level, which is preeminent to various parallel applications viz, solar cells, LEDs, drug delivery, bio-markers, tracers, antibiotics etc. Amongst all drug delivery is embraced by researchers as a substantially significant one. However, the journey from having potential significance to real time application is a tediously intricating one. The foremost interference has come from the poor biocompatibility of these meta materials inside a developed organism, resulting in the lysis of cells due to disintegration of cellular mechanism which finally causes death of the organism. Therefore to avoid such catastrophic condition several steps are required to be taken care of, which primarily includes the engineering of QDs with proper functionalization which can provide rich biocompatibility along with the minimization of entrapping reagents without perplexing their gilded luminescence behaviour. In this review the authors are addressing the root cause of distressed biocompatibility of quantum dots and how it can be mitigated without compromising their fluorescent emission, raised due to discrete energy levels as well as surface trap states, framing them as better drug delivery agents. The incorporation of Green Chemistry concept is another vital instrument which is to be incripted towards the perfection of utilizing such promising atom like structures in the field of biomedical domain.

Keywords: Quantum Dots, biocompatibility, functionalization, luminescence, Green Chemistry, drug delivery

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Session Classification: Technical Session 03

Track Classification: Track 02

Contribution ID: **53** Type: **Oral**

Phenomenological study of texture zeros in Dirac neutrinos

Abstract:
After classifying all the possible texture zeros in light Dirac neutrino mass matrix in diagonal charged lepton basis, we studied the phenomenology of the texture zeros that are compatible with recent neutrino data. We consider the general (non-Hermitian) nature of the neutrino mass matrix which leads to more possibilities and freedom due to additional CP phases, mixing angles not constrained by neutrino data. We find that textures up to four zeros are allowed in the Dirac neutrino mass matrix by recent neutrino data. The allowed textures are found to give interesting correlations between the light neutrino parameters, especially the neutrino parameters which are not yet perceived with accuracy, the atmospheric mixing angle and the Dirac CP phase, with sharp distinction between the normal and inverted orderings. We try to find the symmetry realizations of some of the allowed texture structures using the Dihedral group D4 and cyclic group Z2. The cosmology bound (PLANCK 2018) on the sum of the neutrinos has been taken into account while finding the allowed texture structures. We then discuss some prospectives of the work from a flavour symmetric point of view.

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Session Classification: Technical Session 02

Track Classification: Track 01

Contribution ID: **54** Type: **Poster**

Green Synthesis of Silver Nanoparticles Using Natural Capping Agents: UV-Vis study and pH-Dependent Size Control

In the realm of nanotechnology, the synthesis of nanoparticles with unique properties and applications continues to be a subject of intense research. Due to its higher electrical as well as thermal conductivity, strong anti-biocidal activities and higher catalytic activity for oxidation of ethylene, silver nanoparticle (Ag-NP) has become intensively studied metal nanoparticles. In this work, we present a novel approach to the green synthesis of Ag-NPs using three natural capping agents: Hibiscus rosa Sinensis, Tulsi (Ocimum sanctum), and green tea (Camellia sinensis). These capping agents, known for their rich phytochemical composition, serve as both reducing and stabilizing agents in the synthesis process. Here, Silver solution served as the precursor material in the synthesis process.

The synthesized AgNPs were characterized using UV-Vis spectroscopy, revealing distinct signature peaks at 443 nm, 448 nm, and 491 nm for Hibiscus rosa Sinensis, Tulsi, and green tea, respectively. These peaks indicate the successful formation of AgNPs. Notably, the observed blue shift of the wavelength suggests variations in the sizes of the AgNPs produced with each capping agent, with Hibiscus rosa Sinensis yielding smaller-sized nanoparticles compared to the other two agents.

Additionally, we investigated the pH of the capping agents prior to synthesis, finding values of 6.67, 5.54, and 5 for Hibiscus rosa Sinensis, Tulsi, and green tea, respectively. These pH measurements revealed an interesting correlation between the alkaline character of the capping agent and the resultant nanoparticle size. This observation provides valuable insights into the pH-dependent control of AgNP size during green synthesis.

Our findings highlight the potential of natural capping agents in tailoring the properties of silver nanoparticles for various applications. This work offers a deeper understanding of the green synthesis process and its pH-dependent size modulation, paving the way for innovative nanomaterial design and utilization in diverse fields.

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Session Classification: Technical Session 03

Track Classification: Track 02

Contribution ID: **55** Type: **Oral**

"A simulation based study on the selectivity of MoSe2 for CO and CO2 gases"

In this paper, we have examined the vital field of gas sensors, which is crucial for environmental monitoring, industrial safety, and healthcare. One of the most important properties of gas sensors is their selectivity, or their capacity to precisely identify and discriminate particular gases in intricate combinations. Selectivity is influenced by a number of important parameters, some of which were brought to light by our inquiry. These include the choice of sensing material, sensing techniques, operating temperature, humidity levels, cross-sensitivity, sensor geometry, gas preconcentration methods, and the usage of sensor arrays. Additionally, we covered a number of physical and chemical processes, including adsorption and desorption, conductivity changes, capacitance variations, optical absorption, mass loading, chemical reactions, heat production or consumption, ionisation, gas diffusion, and changes in mechanical properties that support gas sensor operations. This study used the gas diffusion method and a variety of sensing materials to evaluate the performance of the MoSe2. We observed distinct surface concentration levels in response to CO and CO2 gases on the active surfaces of MoSe2 thorough simulations. On the other hand, MoSe2 responded better to CO2 than to CO. Our results highlight the significance of customising sensor choices based on individual gas detection requirements. As a result, this study clarifies the crucial variables affecting gas sensor selectivity and offers insightful information about the gas-sensing capacities of MoSe2. Additionally, it highlights the potential uses.

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Session Classification: Technical Session 03

Track Classification: Track 02

Contribution ID: **56** Type: **Oral**

Bandwidth Enhancement of Cylindrical Dielectric Resonator Antenna (CDRA) for 5G wireless applications

The dielectric resonator antenna (DRA) has taken the role of conventional radiating antennas with its superiority in radiation gain and efficiency such as microstrip and dipole antenna. These are particularly useful for high frequency applications. In this work, a cylindrical dielectric resonator antenna (CDRA) with coaxial probe feed at different position has been designed and briefly examined. The designed structures can enhance the bandwidth by introducing air gap and repositioning the coaxial probe feed. The material used as dielectric resonator (DR) is Taconic CER which has a dielectric constant of ˜10 and DR is etched on FR-4 epoxy (єr˜4.4) and dimensions of (60 × 60) mm. The widely accessible simulation tool Ansys HFSS is used here to design and examine the proposed CDRAs. The various antenna parameters, such as the gain, directivity, voltage standing wave ratio (VSWR), operating bandwidth, and return loss (S11 vs. frequency) curve, are derived and analysed for the proposed CDRA. By introducing air gap within the CDRA, we obtained much wider operational bandwidth compared to solid CDRA. The designed antennas are operating in the range of (2.30 to 5.71) GHz after optimizing the different dimensional modification.

Keywords: Cylindrical Dielectric Resonator Antenna, Coaxial Probe feeding, Bandwidth Enhancement

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Session Classification: Technical Session 04

Track Classification: Track 03

Contribution ID: **57** Type: **Oral**

Efficiency of AdS-RN black holes as heat engines in the framework of Rastall gravity

We compute the efficiencies of AdS-Reissner-Nordstrom black hole as heat engines in the framework of Rastall gravity. For this purpose, we construct a conventional heat engine system out of a black hole and tried to analyse the influence of various parameters of the theory on the efficiency of the engine. We also compared the obtained efficiencies with the carnot efficiency which is the maximum efficiency that is achievable for any heat engine. It was found that the parameters of the theory namely the charge q, rastall parameter β and structure constant N_s has drastic influence on increasing or decreasing the efficiencies of the black hole heat engines.

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Session Classification: Technical Session 05

Track Classification: Track 04

Contribution ID: **58** Type: **Oral**

A pH-Sensor Based Approach for Rapid Milk Adulteration Detection

Milk adulteration is a pervasive concern that adversely affects progressing countries like India. The addition of adultrants like glucose, caustic soda, refined vegetable oil, common detergent, etc into the milk lowers its nutritious value thereby posing a risk to health. Hence it is very important to test the purity of milk before consumption as synthetic milk and pure milk appear the same and have the same taste.

This paper presents a pH-sensor-based approach designed for rapid and reliable detection of milk adulteration. The system utilizes a pH sensor integrated with an automated detection algorithm to assess the pH levels of milk samples. The pH readings are compared against established pH profiles for pure and adulterated milk, allowing for quick identification of adulterants such as water, milk powder, and detergents. Experimental results demonstrate the efficacy of the pH-sensor system in accurately detecting milk adulteration within seconds, providing a cost-effective and real-time solution for quality assurance in the dairy industry. Preliminary findings demonstrate the effectiveness of the pH sensor in detecting milk adulteration. Adulterated milk samples consistently exhibit distinct voltage variations compared to pure milk, indicating the presence of adulterants. The pH sensor sensitivity enables the detection of even minute concentrations of adulterants, enhancing the accuracy and reliability of the method.

This proposed detection method offers several advantages over traditional techniques. It provides a rapid analysis process, requiring minimal sample preparation and reducing testing time. The simplicity and affordability of pH sensors make them suitable for widespread implementation. The initial findings demonstrate the sensor's effectiveness in identifying adulterants based on voltage variation in milk samples. Further research and validation are necessary to establish the method's accuracy, robustness, and feasibility for integration into quality control practices within the dairy industry.

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Session Classification: Technical Session 04

Track Classification: Track 03

Contribution ID: **59** Type: **Oral**

An ANN based Approach to Correlate Fermentation Condition with Sensory Characteristics of Black Tea

This research paper delves into the profound influence of various process conditions during the fermentation of tea on its sensory attributes. The key parameters under scrutiny in the fermentation process are temperature and relative humidity. These pivotal factors are monitored daily within a tea factory setting, facilitated by the installation of an RS 485 network-based instrumentation system specifically developed for this purpose. Given the substantial dimensions of the fermentation room, diverse sensor nodes are strategically positioned at various locations to ensure comprehensive data collection.To ensure the accuracy of the collected data, a calibration process for the sensor nodes is performed using a standard saturated binary salt solution. Concurrently, assessments of the tea's sensory qualities are conducted by skilled tea tasters. These assessments encompass a spectrum of sensory characteristics, including briskness, strength, body, and brightness, providing qualitative insights into the tea's attributes. Subsequently, we embark on an exploration of the relationships between the fermentation process parameters and the sensory characteristics of tea. Initially, a multivariate linear regression model is developed to establish these connections. An artificial neural network-based technique is further implemented to establish these relationships.The findings of our study reveal the distinct advantages of the artificial neural network method over the conventional multivariate linear regression approach. The results demonstrate that the artificial neural network method shows better results in terms of correlation accuracy. Specifically, our analysis reveals remarkable correlations of 95.53% for briskness, 96.18% for strength, 91.6% for body, and 95.43% for brightness when employing the artificial neural network method. Likewise, the Root Mean Square Error values obtained for the Artificial Neural Network method are 0.079, 0.082, 0.11 and 0.074 for briskness, strength, body and brightness respectively; demonstrate better than the multivariate linear regression approach.

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Session Classification: Technical Session 04

Track Classification: Track 03

Contribution ID: **60** Type: **Poster**

Assessment of Uranium Levels and Water Quality Parameters in Assam Groundwater: Correlation with Nitrate and Phosphate, and Health Risk Evaluation

The study involves the estimation of uranium concentration in 598 groundwater samples obtained from five different districts in Assam during both pre-monsoon and post-monsoon seasons. Additionally, the research encompasses the monitoring of fourteen other water quality parameters. This paper specifically delves into the presence of nitrate and phosphate in groundwater and explores their correlation with uranium levels. Furthermore, for all life stage groups, the annual effective dose, as well as carcinogenic and non-carcinogenic risk, were estimated.

Funding: Board of Research in Nuclear Sciences (BRNS), Department of Atomic Energy, Government of India, (BRNS Project Ref. No. 36(4)/14/12/2014-BRNS/1124-12)

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Session Classification: Technical Session 04

Track Classification: Track 03

Contribution ID: **61** Type: **Poster**

Al3+ ion storage behavior in Polyaniline (emeraldine base) with aqueous electrolyte.

In this report, Polyaniline emeraldine base (PANI-EB) was synthesized by polymerization in ice bath and investigated the electrochemical behavior of Al3+ ion using 1M AlCl3, 0.5 M Al2(SO4)3 and 1M Al(NO3)3 aqueous electrolytes. Reduced graphene oxide (rGO)/PANI-EB and Carbon nanotube (CNT)/PANI-EB composites were also synthesized by in-situ polymerization. The crystallographic characterization was performed by Powder X-ray diffractometer (PXRD), existance of rGO and CNT was verified by Raman analysis. The surface morphology was characterized by SEM analysis. The redox behaviors of pristine PANI-EB, rGO/PANI-EB and CNT/PANI-EB were examined by cyclic voltammetry (CV) and Galvanostatic charge –discharge (GCD) experiments. Cyclic voltammetry (CV) experiments were performed in the potential window (0 - 0.9 V). Pristine PANI-EB delivers initial specific capacities as 103 mAhg-1, 104 mAhg-1 and 54 mAhg-1 at current density 1 Ag-1, which remains 70 mAhg-1, 50 mAhg-1 and 43 mAhg-1 after 100 cycles for the aqueous electrolytes 1 M AlCl3, 0.5 M Al2(SO4)3 and 1 M Al(NO3)3 respectively. Similar behaviors were also observed for the case of rGO/PANI-EB and CNT/PANI-EB. For rGO/PANI-EB, the initial specific capacity was calculated to be 111 mAhg-1, which stand at 64 mAhg-1 and for the case of CNT/PANI-EB, it was 56 mAhg-1, which kept up at 60 mAhg-1 after 100 cycles. The results motivate the approach of PANI based materials for the energy storage devices.

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Session Classification: Technical Session 03

Track Classification: Track 02

Contribution ID: **62** Type: **Oral**

Possibility of collision-less shocks from a moving charge-density object in a dusty plasma with dust of opposite polarities

In recent years, theoretical and numerical studies have been carried out on the excitation of collision-less shocks due to moving charge-density objects in both electron-ion plasma [1] and dusty plasma [2]. However, it is well-established that a dusty plasma can have dust grains of opposite polarity depending on the size of the grains and hence the characteristics of potential shock structures may also differ in such conditions [3].
In this work, we try to explore the possibility of collision-less dust acoustic shocks excited by a charge-density object flowing through a four-component plasma with dust of opposite polarities. We have used a home-grown Flux Corrected Transport (FCT) simulation to study the characteristics and evolution of the shock structures with time in the nonlinear regime, using the density perturbation method. We also study how these structures differ from usual viscous or collisional shocks arising in the same model. Preliminary results from the simulation along with theoretical explanations will be presented.

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Session Classification: Technical Session 05

Track Classification: Track 04

Contribution ID: **63** Type: **Poster**

NON-IRIDESCENT STRUCTURAL COLORATION IN THREE DISTINCT COLORS OF BOUGAINVILLEA FLOWER PETALS

The topic of structural color is crucial in the current world since it affects both industrial applications and our day-to-day lives. The current study delves further into the significance of microstructures in determining the visual appearance of three distinct colors of bougainvillea flower petals: pink, yellow-orange, and white. With the aid of a field-emission scanning electron microscope (FESEM), the surface morphologies of the petals are investigated. We affirm that micro-papillae and nanostructures present on the surface would dictate the color of the aforesaid specimen-types along with the pigments may bring in any observable differences. A sophisticated micro-spectrophotometry technique has been employed to acquire the normal reflectance and polarization-sensitive reflectance features. The nature of reflectance characteristics corresponding to their microstructures has been studied. Again, we anticipate that the random arrangements of the epidermal cells provide sensitivity to the specimen towards polarized light. Also, ethanolic media of different refractive indices have been used to demonstrate the contribution of structural color. However, angle-resolved UV-vis spectral response confirms that the observed structural color is non-iridescent in nature. An attempt has also been made for biomimicking petal microstructure using PVA polymer negative replica. Our study is expected to unfold new insights that may have value in the fields of nanophotonics, nanocoatings, textile design, etc.

Keywords: Structural color; Reflectance; Polarization; Iridescence; Biomaterial; Biomimicking

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Session Classification: Technical Session 03

Track Classification: Track 02

Contribution ID: **64** Type: **Oral**

Effect of heavy impurities on thermal conductivity of glass-forming liquids

The unique low-temperature characteristics exhibited by disordered materials have garnered significant research attention over an extended period. These materials' specific heat and thermal conductivity properties are termed as *anomalous* to emphasize their intriguing deviations from those observed in crystalline materials. Consequently, they have attracted substantial investigative efforts, both in experimental and theoretical domains. Our study involves an investigation into the impact of heavy impurities on the thermal conductivity of glass-forming liquids. To achieve this, we employ a combination of non-equilibrium molecular dynamics simulations and numerical techniques. Within our model for glass formers, heavy impurities are introduced by a random selection of particles, with their mass adjusted accordingly. In the extreme scenario, quenched disorder is introduced by randomly pinning a fraction of the particles. With increased quenched disorder via increasing the fraction of pinned particles, the energy current in the system set due to the application of thermal gradient in non-equilibrium simulation decreases, and as a result the thermal conductivity decreases rapidly. Our findings demonstrate a swift transformation in the localization characteristics of low-frequency vibrational modes of the underlying solid, resulting in a marked reduction in thermal conductivity as the mass of impurities or the fraction of pinned particles increases. Further, it is shown that it is possible to transform the low-frequency extended modes to acquire quasi-localized character by the introduction of quenched disorder, which in turn contribute to the reduction of thermal conductivity.

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Session Classification: Technical Session 03

Track Classification: Track 02

Contribution ID: **66** Type: **Oral**

Comparative study of Parton distribution functions in the CTEQ framework

Abstract: The studies of the Parton distribution function (PDFs) open a new way to a better understanding of the partonic quark-gluon structure of the nucleon. In the QCD study of high-energy processes, PDFs are essential. We study a few PDF sets with various Q2 ranges and momentum fraction x. All PDFs'numerical values have been taken from the LHAPDF library, a user-friendly interface to PDF sets. In our current study, we compare the PDF sets and plots using APFEL.
Keywords: QCD, PDFs, Momentum fraction x.
References:
[1] S. Forte and G. Watt, "Progress in the determination of the partonic structure of the proton", Annu. Rev. Nucl. Part. Sci. 63, 291 (2013).
[2] V. Bertone, S. Carrazza and J. Rojo, "APFEL: A PDF Evolution Library with QED corrections", Comput. Phys. Commun.185, 1647 (2014).

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Session Classification: Technical Session 02

Track Classification: Track 01

Contribution ID: **67** Type: **Poster**

Potential of CdS/CdTe-based Multi-Junction Photovoltaic Cell for Indoor Light Harvesting: A Simulated Study

In recent years, there has been a noteworthy surge in interest surrounding indoor photovoltaic (IPV) devices due to their promising potential for powering small, portable electronics and self-powered Internet of Things (IoT) devices. Cadmium Telluride (CdTe) solar cells stand as a significant player in the global photovoltaic (PV) technology landscape, ranking as the second-fastest-growing PV technology after crystalline silicon. CdTe-based photovoltaic (PV) cells have demonstrated remarkable efficiency under outdoor sunlight conditions. However, their potential for indoor light harvesting remains relatively unexplored. This work presents a comprehensive study on the application of CdTe-based multi-junction photovoltaic cells in indoor environments.

In this work, a multi-junction photovoltaic structure "ITO/SnO2/CdS/CdTe/Au"was modelled and analysed for its photovoltaic performance using SCAPS-1D modelling software. The simulations were conducted under LED light conditions, with a power density of approximately 60 W/cm2 and a temperature of 300 K. The primary focus of this study was the impact of donor concentrations and layer thicknesses on cell performance, with an emphasis on optimization rather than the optical and morphological properties of the layers.

Through systematic optimization of each layer, the study achieved an outstanding efficiency of 20.70% under indoor LED lighting. The optimized device exhibited a high open-circuit voltage (VOC) of 0.945 V, a current density (JSC) of 2.13 mA/cm2, and a fill factor (FF) of 64.02%. These results were obtained at the doping concentration of 1017 cm-3 (SnO2), 1015 cm-3 (CdS), 1015 cm-3 (CdTe), and at the thickness of 50 nm (SnO2), 70 nm (CdS), 900 nm (CdTe). These results highlight the substantial potential of CdS/CdTe-based multi-junction PV cells for efficiently harnessing indoor light sources, paving the way for their integration into a wide range of portable and IoT devices. This research not only contributes to the advancement of indoor photovoltaics but also underscores the importance of tailored device design and optimization for specific lighting conditions

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Session Classification: Technical Session 04

Track Classification: Track 03

Contribution ID: **68** Type: **Oral**

Approximate Controllability of Fractional Dynamical System with Impulses and Non-Local Initial Condition

In this paper, a fractional dynamical system is considered involving instantaneous impulses and non-local initial conditions. The fractional derivative is taken in Caputo sense with order $\alpha \in (0, 1)$. The operator used in the system is the infinitesimal generator of an analytic semigroup on a Hilbert space. Sufficient conditions are derived to prove the existence of the mild solution of the system using generalized Banach contraction principle. Krasnoselskii fixed point theorem is used to establish the approximate controllability of the system.

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Session Classification: Technical Session 05

Track Classification: Track 04

Contribution ID: **69** Type: **Oral**

Self-interacting Dark Matter in the Light of Non-Standard Cosmology

The cold, collisionless dark matter (DM) postulated in the ΛCDM model leads to several small scale anomalies such as the cusp-core problem, the missing satellites problem and the too big to fail problem. Self-interacting dark matter (SIDM), a promising alternative type of dark matter, not only alleviates the small scale anomalies, but also matches with highly accurate large scale predictions of the ΛCDM model. However, in the standard cosmology, the thermal relic of SIDM is below the observed DM relic density due to large annihilation cross-section. Therefore, we make an attempt to realise the correct thermal relic of SIDM by assuming a non-standard cosmological history. This is achieved by introducing an additional scalar field to the standard scenario. The SIDM is assumed to be a Dirac fermion, while the mediator needed to facilitate the self-interaction can be either a light scalar or boson. We study the phenomenological consequences in the SIDM sector in non-standard cosmology, including relic density, direct and indirect searches. We find out the viable parameter space for the model after confronting with relevant phenomenological and experimental constraints.

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Session Classification: Technical Session 02

Track Classification: Track 01

Contribution ID: **70** Type: **Oral**

Noise-Assisted Control of Chaotic Dynamics in the Ikeda Map with Balanced Gain and Loss

In this work, we investigated the temporal evolution of optical power in the Ikeda Map with Balanced Gain and Loss. The system comprises two feedback loops which impart saturation nonlinear phase shift on the propagating fields and interact with each other via a 50:50 directional coupler. The attenuation and amplification are distributed equally in the feedback loops in the configuration. From the bifurcation diagram, it could be inferred that the system exhibits the period-doubling cascade to chaos as a function of the gain/loss parameter. In the chaotic regime, we have found that a static input signal leads to the emergence of chaotic dynamics in the system. But if the input signal is superimposed with Gaussian noise, then the temporal dynamics in the system could be transformed from chaotic to noisy periodic. Furthermore, considering a total of 100 cases, we evaluated the probability of chaos control in the system.

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Session Classification: Technical Session 04

Track Classification: Track 03

Contribution ID: **71** Type: **Oral**

Correlation between spatiotemporal patterns and local instability

Patterns emerge in spatially extended systems at all scales, from astronomical to micrometer. The appearance of galaxies in a spiral, elliptical, or irregular form, the patterns formed by a starving colony of slime molds, wind-swept sand patterns in rivers and deserts, patterns in zebra and snow leopards are a few examples. The hexagonal pattern in Rayleigh-Benard experiment and spiral wave in Belousov-Zhabotinsky chemical reaction are such examples in laboratory experiments. These patterns can be simple or complex, static and dynamic i.e., patterns vary both in space and time, called spatiotemporal patterns. In general, the dynamics of the spatiotemporal patterns attributed to the local instabilities that emerge around their equilibrium point or fixed points when driven out of equilibrium also depends on the nature of the driving field. Then, a natural question arises: do the local instabilities keep all the information about the nature of the spatio-temporal patterns? In other words, can seemingly equivalent linear instability give rise to various spatiotemporal patterns?

To address the question, we consider the spatially extended Ananthakrishna's (AK) model, a dynamical model developed to understand the plastic instability of crystalline materials system. The AK model captures all the generic spatiotemporal patterns that appear in a dynamic experiment as a function of the control parameter. The model has a broad instability spectrum associated with the control parameter. We observed that seemingly identical local linear instability with distinctly different control parameters gives rise to distinct spatiotemporal patterns. To understand the origin of the changing nature of the spatio-temporal pattern as a function of the control parameter, we evaluate the Lyapunov spectrum that calculates the time scales associated with each degree of freedom. Our study reveals that the nature of spatiotemporal patterns depends on the separation of participating time scales. While a large difference in the average value of participating time scales gives rise to static and randomized spatiotemporal patterns, uniformly distributed competing time scales give rise to continuous patterns. This information is not apparent in the local instability and is therefore not adequate to explain various dynamic spatiotemporal patterns in extended systems.

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Session Classification: Technical Session 05

Track Classification: Track 04

Contribution ID: **72** Type: **Oral**

Non-Linear Wave Equation for the Vibration of a String Under Arbitrary Deformation and Under Non-Uniform Tension

The well-known one-dimensional wave equation for a vibrating string holds good only for slowly varying waves with the motion being confined in a plane. Furthermore, it is assumed that the strain is uniform and small. Here we generalize the wave equation for the vibration of a string under non-uniform tension and arbitrary initial deformation.

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Session Classification: Technical Session 05

Track Classification: Track 04

Contribution ID: **73** Type: **Oral**

A Study of a Nonlinear Model of COVID-19 Transmission with Vaccination

The coronavirus disease (COVID-19) was first observed in December 2019 in the Wuhan Province of China and then it spread throughout the world. It affected the whole world in the most devastating way possible. In this paper, a nonlinear differential equation-based mathematical model is proposed to describe the spread dynamics of COVID-19 with the consideration of some important factors like self-protection and vaccination. The basic reproduction number of the model, which is a critical signal of the dynamics of COVID-19 transmission, is calculated using the next-generation matrix method. The local stability of the steady states has been investigated. Moreover, global stability is demonstrated using the second method of Lyapunov and the LaSalle invariance principle. In addition, the effect of vaccination on the evolution of the disease spread has been studied. Further, an optimal control problem is formulated and solved to reduce the number of infected individuals and the cost of the controls by considering self-protection and vaccination as intervention options. It is found that the introduction of intervention affects the transmission dynamics of the COVID-19 pandemic. Finally, the theoretical aspects have been validated by extensive simulations conducted for various initial conditions and parameter values.

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Session Classification: Technical Session 05

Track Classification: Track 04

Contribution ID: **74** Type: **Oral**

Variation of globular protein adsorption on fatty acid Langmuir Blodgett films of different thicknesses with different solution pH

Fatty acid Langmuir monolayers and multilayers are very fascinating two-dimensional system formed at the air-water interface. These layers show thermodynamically metastable behaviours through different phases and phase transitions. Langmuir-Blodgett (LB) films provide the transfer of monolayer onto solid surfaces to study their morphological, structural, and optical properties. Similarly, protein adsorption on fatty acid monolayers/ bilayers may show cell membrane-protein interactions at the molecular level. The structural, optical behaviours of proteins change as they get attached or adsorb onto any solid surface which leads to changes in the proteins' physiological functional behaviour. In this study, we try to understand how fatty acid monolayers and multilayers affect the adsorption of globular protein Bovine Serum Albumin (BSA) and structural modifications of BSA proteins as well. In this study Arachidic acid monolayer and tri-layer LB films had been prepared in presence of Barium ion in the Subphase on Si (100) hydrophilic substrate at Subphase pH ≈ 7.0. X-Ray Reflectometry (XRR) and Atomic Force Microscopy (AFM) data confirms the deposition of Ba-Arachidate (BaAr) monolayer and tri-layer on Si (100) substrate. After that adsorption of BSA protein molecules on the LB film surfaces had been done on different solution pH at 4.0, 5.0 & 7.0. BSA solution was prepared with Milli-Q water and pH was maintained. The LB films were dipped vertically for about 15 mins and removed from the solution and let the sample dry in vertical position. XRR and AFM data clearly reveals the morphological and structural information of BSA adsorption as well as the structural change of the underlying fatty acid layers in presence of different solution pH. To confirms the BSA proteins conformational changes FTIR data were taken in the Attenuated Total Reflectance (ATR) mode of all films. ATR-FTIR data reveals the BSA conformational changes which was expected. Change of BSA surface charge with proteins and the modifications in the hydrophobic-hydrophobic interactions plays key role in the adsorption of proteins on the BaAr monolayer and tri-layer LB films. Further analysis of the data will provide more insights of the interactions and among the BSA protein molecules and the BaAr fatty acid layers.

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Session Classification: Technical Session 03

Track Classification: Track 02

Contribution ID: **75** Type: **Oral**

IoT-Based Plant Monitoring and Automated Irrigation: Transforming Agriculture for Sustainable Growth and Resource Efficiency

As the global population continues to expand, the demand for increased food production places substantial pressure on agriculture to optimize resource use and mitigate plant stress. Modern technologies, such as IoT-based plant monitoring and automated irrigation, offer vital solutions. These systems utilize sensors and technologies to continuously monitor soil moisture, environmental conditions, and plant health, alleviating plant stress. Real-time data optimizes irrigation, conserving water, and improving yields. These systems also regulate greenhouse conditions for various crops. In this context, IoT-based solutions represent a transformative advancement in agriculture, crucial for regions with limited water supplies or impractical manual watering.

This work focuses on an IoT (Internet of Things)-based plant monitoring system. It collects real-time data on soil moisture, ambient temperature, and humidity using a capacitive soil moisture sensor from Xcluma and the DHT11 temperature and humidity sensor. This data is processed, activating instruments to maintain optimal parameters essential for plant growth. The system also alerts users when unfavorable conditions arise, such as low soil moisture, high temperatures, or insufficient humidity. To achieve these goals, we employed a capacitive soil moisture sensor from Xcluma and the DHT11 sensor. The data acquisition system utilized an ATmega 328P-based Arduino Uno development board, while an ESP8266 microcontroller served as the IoT module, transmitting data to the cloud. Calibration involved drying soil to remove humidity, followed by systematic increments of water up to 80 ml while recording data. The DHT11 sensor recorded ambient temperature and humidity readings every 5 minutes. A web application with a smartphone dashboard was created for remote monitoring. An algorithm autonomously controlled and monitored the irrigation supply.

In summary, the fusion of IoT technology with agriculture represents a frontier of agricultural innovation. The IoT-based plant monitoring and automated irrigation system exemplify technology's capacity to transform farming practices, optimize resources, increase yields, and promote sustainability. These systems showcase our ability to use technology to enhance agriculture and preserve natural resources.

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Session Classification: Technical Session 04

Track Classification: Track 03

Contribution ID: **76** Type: **Oral**

Computational Fluid Dynamics in Action: Optimizing Electronic Nose System Performance Through CFD-Simulated Gas Chamber Design

The electronic nose system is a remarkable technological advancement that replicates the olfactory capabilities of humans and animals using electronic sensors. These sensors generate electrical responses that correspond to the presence and concentration of specific analyte gases, making them invaluable in various applications, including environmental monitoring, quality control in the food industry, and even medical diagnostics. In our pursuit of optimizing the performance of an electronic nose system, we turned to Computational Fluid Dynamics (CFD) simulation. This sophisticated tool is employed by engineers and scientists to comprehensively understand, predict, and fine-tune fluid flow behaviors within both closed and open systems. Specifically, we harnessed the power of CFD simulation in the design of a gas chamber intended to house the sensor array within the electronic nose system. The gas chamber plays a pivotal role in ensuring the accuracy and efficiency of the system. It serves as the environment where analyte odor molecules interact with the electronic sensors, ultimately leading to the generation of electrical responses

The gas chamber itself was designed, featuring a diameter of 20 mm and a length of 100 mm. The pressure conditions were simulated at 75 kPa, providing the necessary suction to the analyte gas. Our CFD simulation approach was meticulously crafted to achieve uniform and streamlined flow of these analyte odor molecules throughout the gas chamber. To attain this, we designed a finely calibrated array of small cylindrical holes, each with a diameter of 0.8 mm. These holes were strategically distributed across the cross-section of the main cylinder at the chamber's inlet. We carefully fine-tuned the number of these cylindrical holes as well as the diameter of these holes to achieve an even more streamlined and uniform flow of air. Through a series of simulations and optimizations, we determined that the most effective chamber design incorporated an air inlet with a diameter of 5 mm, complemented by a matching 5 mm outlet.

In summary, the use of CFD simulation in the design of the gas chamber for our electronic nose system is instrumental in ensuring the system's precision and reliability. By carefully orchestrating fluid dynamics within the chamber, we have elevated the system's performance, making it a valuable tool for a wide range of applications where the detection and analysis of analyte gases are paramount.

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Track Classification: Track 03