Sl. No.	IIT Ropar List of Recent Publications with Abstract Coverage: July, 2021
1.	5G Enabled VANet: Enhancing the Capabilities of Vehicular Communication Network R Singh, D Saluja, S Kumar - IEEE International Conference on Communications Workshops, 2021 **Abstract:** Vehicular communication requires low latency, high speed and ultra-reliable transmission. However, the increase in popularity of connected vehicles, as well as rapid change in vehicular topology, limits the capabilities of the current vehicular network. Thanks to 3GPP release 16 as well as the outlines of release 17, which indicates that the next generation radio is showing great interest in the applications which require ultrareliable, low latency communication. In this work, we study critical requirements of the vehicular communication network along with several state of the art techniques towards mitigation of these problems. Besides, we discuss the 5G radio roadmap towards the fulfilment of vehicular network challenges, and several key enhancement and newly added verticals have been explained from the vehicular viewpoint.
2.	A comparative study on widely used data processing approaches for infrared non-destructive testing and evaluation of concrete structures R Mulaveesala, G Dua, A Rani, A Sharma, K Kaur - Proceedings Volume 11743, Thermosense: Thermal Infrared Applications XLIII, 2021 **Abstract:** Infrared non-destructive testing and evaluation is one of the promising inspection methods for characterization of wide verity of materials due to its merits and applicability to test materials irrespective of their electrical, mechanical, acoustical and magnetic properties. Among the various infrared non-destructive evaluation modalities such as pulse based thermography and mono frequency excited modulated lock-in thermography, recently proposed matched filter based non-periodic infrared thermographic approaches gained their importance due to their superior sub-surface defect detection in terms of resolution and sensitivity. The present work demonstrates the merits of frequency modulated thermal wave imaging for identification of concrete in concrete structure. Obtained results shows the matched filter based post-processing schemes exhibits better depth scanning capabilities compared with the conventional frequency domain phase approach to detect corrosion in the concrete structures.
3.	A Microcontroller based Charge Balanced Trapezoidal Stimulus Generator for FES System B Basumatary, RS Halder, A Sahani - IEEE International Instrumentation and Measurement Technology Conference, 2021 **Abstract:** Foot drop (FD) is the inability to lift the front part of the foot from the ground. It causes the toes to drag along the ground while walking and can cause fall and injuries. A patient may have FD when there is a loss of communication between the central nervous system and the peroneal nerve. It can be corrected by functional electrical stimulation (FES) of the peroneal nerve by applying pulses of a given duration, amplitude, and frequency. In this paper, we are proposing a microcontroller based FES system that produces trapezoidal, charge-balanced, biphasic stimulus output with near-zero DC level. In this design, we use a programmable ESP32 microcontroller with a built-in DAC, uniphasic to biphasic converter circuit, current amplifier and step-up transformer. Stimulation amplitude, pulse width and frequency of the stimulation pulse can easily be adjusted by using an adjustable knob. The cost of the overall system is very low and can be built using standard electronic components.
4.	A Navigation System for Safe Routing R Kaur, V Goyal, VMV Guntur, A Saini, K Sanadhya… S Ratra - 22nd IEEE International Conference on Mobile Data Management, 2021 **Abstract:** Globally, women are cautious when planning their routine travel routes. In a recent

	survey on street harassment, 82% of international respondents reported taking a different route to their destination than the conventional route due to fear of harassment. Such studies indicate an increasing need for 'Safe Routing', especially in developing nations where the lack of infrastructure such as street lights, may contribute to higher crime rates. However, to the best of our knowledge, no state-of-the-art navigation system provides the option of 'Safe Routing'. In this work, we propose a novel system that recommends "Safe Routes". Routes recommended by our system balance the conflicting requirements of increasing the safety and constraining the total length of the path to be within a reasonable limit (as desired by the user). From a theoretical perspective, the problem of 'Safe Routing' can be modeled as the Arc Orienteering Problem, which is a well-known NP-hard combinatorial optimization problem.
5.	A Novel Centralized Islanding Detection Scheme Using Teager-Kaiser Energy of Distribution-Level Synchrophasors K Chauhan, R Sodhi - IEEE 12th Energy Conversion Congress & Exposition - Asia, 2021 **Abstract:** This paper proposes a novel Centralized Islanding Detector (CID) based on the synchrophasor data collected by the Distribution-level Phasor Measurement Unit (DPMU). The Teager-Kaiser energy of voltage phase angle difference between DG bus and reference substation bus is utilized as a key indicator to differentiate between Islanding and non-Islanding events. The efficacy of the proposed method is verified on a modified IEEE 33 bus test-system under various test scenarios such as loss of mains, single/multiple DG Island with zero/non-zero power mismatch, load shedding, capacitor switching, faults, motor starting, etc. Furthermore, superiority of the proposed method with other centralized Islanding detection schemes in terms of parameter selection, detection time, computational complexity and non detection zone is elaborated. The proposed indicator can work in accordance with advance distribution management system for wide-area situational awareness.
6.	An empirical investigation of the effects of competition, efficiency and risk-taking on profitability: An application in Indian banking B Rakshit, S Bardhan - Journal of Economics and Business, 2021 **Abstract:** The study investigates whether changes in bank competition, efficiency, and risk-taking affect the profitability of Indian commercial banks during 1996−2016. While assessing the determinants of profitability, this study considers a wide range of bank-specific, macroeconomic, and institutional factors that explain the variations in bank profitability. Results estimated through the two-step system GMM indicate that a higher level of bank competition deteriorates bank profitability in Indian banking. Regarding risk-taking, results reveal that the growing incidence of credit risk hampers bank profitability for the whole banking industry and across ownerships. However, higher levels of profit and cost efficiency are positively associated with bank performance. Other bank-specific, macroeconomic, and institutional variables appear to have influenced bank profitability in India. The joint effect of competition and efficiency (or risk-taking) has further been examined in this study.
7.	Analysis of mass-separated evaporation residues formed in $^{32}S + ^{70,68}Zn$ fusion reactions: The special case of $^{97,95}Ru$ D Kumar, M Maiti, R Prajapat, A Chauhan, R Biswas…RN Sahoo… - Physical Review C, 2021 **Abstract:** Background: The experimental knowledge of nuclear reaction data and decay properties plays a vital role in searching for novel and exotic radioisotopes, prompting us to widen the experimental study of heavy-ion induced reactions. Purpose: The aim is to study the production of mass separated (i.e., separation of different masses of residues, where each mass group consists of isobaric nuclei) evaporation residues (ERs) populated in 32S+70Zn and 32S+68Zn reactions within 115–135 and 130–150 MeV incident energy ranges, respectively, and optimization of masses 97 and 95 u that consist

	of 97Pd, 97Rh, 97Ru, and 95Pd, 95Rh, 95Ru, 95Tc isobaric residues, respectively. Method: Mass separation of ERs has been achieved at the focal plane of the Heavy Ion Reaction Analyser (HIRA) at the 15 UD Pelletron facility, IUAC, India. The residues were detected at the focal plane of HIRA using a multiwire proportional counter (MWPC). Results: Competing production of masses 97 and 95 u through the fusion of 32S ions with 70Zn and 68Zn, respectively, have been observed in comparison to their neighboring masses within the measured energy range. The maximum cumulative production of 97Ru has been found to be ≈99±9.9 Bq/hpnA(mg/cm2) at 125 MeV, while for 95Ru it is ≈69±6.9 Bq/hpnA(mg/cm2) at 135 MeV. Comparisons of experimental results with the theoretical calculations indicate that the residues are mainly populated through the compound reaction mechanism. Conclusions: As anticipated from theory, significant yields of 97Ru and 95Ru in reactions 32S+70Zn and 32S+68Zn have been achieved via cumulative production of different isobars of mass 97 and 95 u, respectively. Cumulative yield of 97Ru has been found to be equivalent, i.e., the same order of magnitude [viz., ≈107 nuclei/h pnA(mg/cm2)], compared to its independent production through 11B and 7Li projectile induced reactions.
8.	Analyzing the Spread of Infectious Disease Using a Probabilistic Model S Saxena, S Khare, S Pal, V Agarwal - IEEE International Conference on Communications Workshops, 2021 **Abstract:** Infectious diseases are those that can be transmitted from person to person upon some form of contact. In this regard, airborne infectious diseases can wreak quite a havoc as they have a high degree of infectiousness and can easily infect a healthy person who comes in proximity of an infected person for a specific interval of time. The situation can take the form of an epidemic in no time if the outbreak of a disease is not checked at an earlier stage. In this paper, we simulate the spread of airborne infectious disease in the city population. Disease transmission from an infected person to a healthy person is modeled based on proximity and contact time. We analyze how population density affects the spread of disease. Moreover, we also analyze how practices like wearing a mask and hotspot lockdowns might slow down the spread of infection. Finally, we analyze how an epidemic mitigates when a certain fraction of the population becomes immune to the disease. Observations and inferences drawn from the simulation results can help make policies to tackle the spread of airborne infectious disease in a city community.
9.	Assessment of process parameters and performance enhancement through a novel suction flushing technology in RμEDM H Kishore, CK Nirala, A Agrawal, B Kuriachen - Materials and Manufacturing Processes, 2021 **Abstract:** Reverse micro electro-discharge machining (RμEDM) is a promising and cost-effective technology for fabricating unconventional shaped single and arrayed micro-pins of high aspect ratio. However, dimensional inaccuracies, poor surface finish and long machining time are of great concern. An experiment-based detailed investigation of process parameters for analyzing various machining responses has been performed in this article. Taguchi's L16 orthogonal array design of experiments has been used to frame out the experimental runs. Discharge voltage, capacitance and feed rate have been considered as process parameters whereas, material removal rate, taper root angle, surface roughness and machining time as responses for the fabrication of a single micro-pin. Additionally, the feasibility of a novel high-pressure suction flushing technology implemented for RμEDM has been demonstrated. The performance of this technology is verified for better surface quality and lesser machining time. It is observed that by using the proposed suction technology, along with the suitable parametric settings, the micromachining time significantly improved (~20%) while fabricating an arrayed micro-pins in elliptical cross-sections profile.

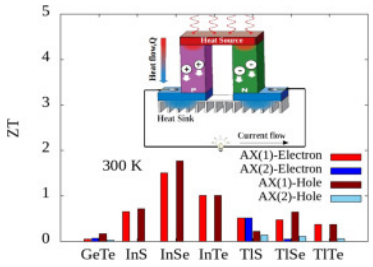
10.	Auscl-D: a mercury-free digital auscultatory sphygmomanometer V Kumar, R Kumar, M Kumar, GS Wander, A Sahani - Journal of Medical Engineering & Technology, 2021 **Abstract:** More than quarter of world's population is consumed by hypertension, leading to premature death of thousands of people per year across the globe. One of the major reasons behind hypertension misdiagnosis is inaccurate blood pressure (BP) measurements, which can be attributed to various human or instrumentation errors. Currently used BP measuring sphygmomanometers, suffers from poor reliability, performance deterioration over time or are unable to meet environmental protection protocols. In this article, we propose a low-cost, highly portable, light-weight, easily manufacturable, battery operated, mercury free, auscultation based digital sphygmomanometer – Auscl-D, for easy and accurate BP measurements. The proposed device can be made from easily available components with cheap manufacturing processes available throughout globe, even in remote areas. The device demonstrated to have accuracy comparable to mercury sphygmomanometer, which is the gold-standard for BP measurements. The preliminary clinical trials were conducted at Dayanand Medical College & Hospital (DMCH) (Ludhiana, India), to compare the performance of proposed device with commonly used aneroid sphygmomanometers employing the auscultatory method and validated oscillometric sphygmomanometers from MicroLife. The test results show good agreement for systolic and diastolic BP measurements taken using Auscl-D device compared to the aneroid and oscillometric types. This shows the potential of proposed design to serve as low-cost, highly portable replacement for conventionally used sphygmomanometers, without the toxicity and reliability issues.
11.	Autofocusing and Self-Healing Properties of Aberration Laser Beams in a Turbulent Media V Dev, ANK Reddy, AV Ustinov, SN Khonina, V Pal - Physical Review Applied, 2021 **Abstract:** We present the autofocusing and self-healing properties of aberration laser beams (ALBs) in a turbulent media. The ALB is generated by a diffractive optical element (DOE) whose phase profile consists of radial and periodic angular dependence, and then propagated through a turbulent media under weak, moderate, and strong turbulence conditions. The theoretical calculations, numerical simulations, and experimental results are presented. The results show that the presence of turbulence leads to distortion in the spatial structure of ALBs, as well as causes beam wandering. However, the autofocusing properties of ALBs remain invariant. Further, ALBs also possess self-healing abilities in free space as well as in a turbulent media. The self-healing sustains reasonably well even when a large portion of ALB (approximately 60%) is truncated. The distance requires for the self-healing of truncated ALBs remains the same for various percentage of truncation. Particularly, for any amount of truncation up to approximately 60%, ALB self-heals by propagating up to autofocusing distance corresponding to a nontruncated beam.
12.	Climate-driven acceleration in forest evapotranspiration fuelling extreme rainfall events in the Himalaya N Singh, J Singh, AK Gupta, A Bräuning, AP Dimri… RK Tiwari - Environmental Research Letters, 2021 **Abstract:** Warming-induced expansion in vegetation coverage and activity can accelerate the montane hydrological regimes. However, the climate impacts on ecohydrology of forested valleys of the Himalaya are uncertain. In this study, utilizing results of about three centuries of cellulose isotope chronologies (δ13C and δ18O) of dominant tree species, geo-chronological proxies, bio-geophysical dataset and simulations including satellite observations, we show an activation in the ecophysiological processes including evapotranspiration since the 1950s. Observation suggests rapid greening, while isotopic records indicate enhanced assimilation and transpiration in deciduous species vis-à-vis conifers post 1950s. Given strong vegetation-precipitation feedback and superimposed on the increasing trends of conducive atmospheric factors affecting valley-scale convective processes, intensification in forest evapotranspiration is manifesting in a progressive

	enhancement in extreme rainfall events (EREs) since the last few decades. Results suggest that representation of ecophysiological processes and dynamics of seasonal moisture loading in observational and modelling framework is critical for understanding EREs under climate change.
13.	Demosaicing Method for Multispectral Images Using Derivative Operations M Gupta, P Goyal - American Journal of Mathematical and Management Sciences, 2021 **Abstract:** Multispectral images have been found useful for various applications such as remote sensing, medical imaging, military surveillance, vision inspection for food quality control, etc. but the high costs of multispectral cameras limit their usage. Low cost multispectral cameras can be developed using a single sensor multispectral filter array (MSFA) and a demosaicing method to reconstruct the complete image from under sampled multispectral image data acquired using a single sensor MSFA imaging system. In this paper, we present a new demosaicing method based on the derivative operations for the multi-spectral images. To design MSFA patterns, binary tree method is often used and the band sequence is chosen such that the middle band has a higher probability of appearance in MSFA pattern. In the proposed method, first the middle spectral band pixel values are estimated and then it is used to compute derivatives that help estimate other spectral band pixel values. Unlike many recently developed demosaicing methods that are applicable to only specific band size multispectral images, the proposed method is generic and can be applied to obtain multispectral images for any number of spectral bands. The TokyoTech dataset and CAVE dataset of multispectral images are used for the evaluation purpose, and the experimental results show that the proposed method outperforms currently best known generic multispectral demosaicing method, namely binary tree edge sensing (BTES) method on both datasets and for different band-size multispectral images.
14.	Disease Detection in Apple Leaves Using Deep Convolutional Neural Network P Bansal, R Kumar, S Kumar - Agriculture, 2021 **Abstract:** The automatic detection of diseases in plants is necessary, as it reduces the tedious work of monitoring large farms and it will detect the disease at an early stage of its occurrence to minimize further degradation of plants. Besides the decline of plant health, a country's economy is highly affected by this scenario due to lower production. The current approach to identify diseases by an expert is slow and non-optimal for large farms. Our proposed model is an ensemble of pre-trained DenseNet121, EfficientNetB7, and EfficientNet NoisyStudent, which aims to classify leaves of apple trees into one of the following categories: healthy, apple scab, apple cedar rust, and multiple diseases, using its images. Various Image Augmentation techniques are included in this research to increase the dataset size, and subsequentially, the model's accuracy increases. Our proposed model achieves an accuracy of 96.25% on the validation dataset. The proposed model can identify leaves with multiple diseases with 90% accuracy. Our proposed model achieved a good performance on different metrics and can be deployed in the agricultural domain to identify plant health accurately and timely.
15.	Dragon-king extreme events as precursors for catastrophic transition D Premraj, K Suresh, SA Pawar, L Kabiraj, A Prasad… - EPL (Europhysics Letters), 2021 **Abstract:** Unexpected catastrophic transitions are often observed in complex systems. However, the prediction of such transitions is difficult in practice. Here, we find a special kind of extreme events with a dragon-king probability distribution that occur just prior to a catastrophic transition and, hence, can serve as its precursor. To illustrate the application of dragon kings as a precursor, we consider a practical experimental thermo-fluid system and a theoretical model of coupled logistic maps with quasi-periodic forcing, both systems displaying a catastrophic transition.

16. [Drastic Reduction of Thermal Conductivity in Hexagonal AX (A= Ga, In & Tl, X= S, Se & Te) Monolayers due to Alternative Atomic Configuration]
A Majumdar, S Chowdhury, R Ahuja - Nano Energy, 2021

Abstract: Several two-dimensional chalcogenide materials have been in the limelight in the recent past for their promising thermoelectric properties. It is well established that the thermoelectric performance of materials improves on reducing the physical dimensionality of the system. Two-dimensional hexagonal chalcogen (S, Se and Te) bearing compounds of Ga, In and Tl have already been studied extensively in literature. But in those phases, the group-13 non-chalcogen atoms occupy the two inner planes while the chalcogens occupy the two outer planes of the unit cell. In this work, we have proposed the alternate arrangement in which the chalcogen atoms occupy the two inner planes while the group-13 atoms occupy the two outer planes of the unit cell. Unprecedentedly, this alternate arrangement shows much lower thermal conductivity that leads to superior thermoelectric performance. In this work we have studied in details the thermoelectric properties of hexagonal AX (A = Ga, In & Tl, X = S, Se & Te) monolayers and compare the results having both the atomic arrangements. The very low lattice thermal conductivity of this new arrangement is due to the outermost valence s-orbital lone pair of the chalcogens which leads to enhanced anharmonicity. We have explained these results from the anti-crossing of the phonon branches as well. The electronic, dynamical, thermodynamical and elastic properties have also been studied. We think that these results should have significant impact on the synthesis of high-performance thermoelectric materials based on chalcogenides of gallium, indium and thallium.

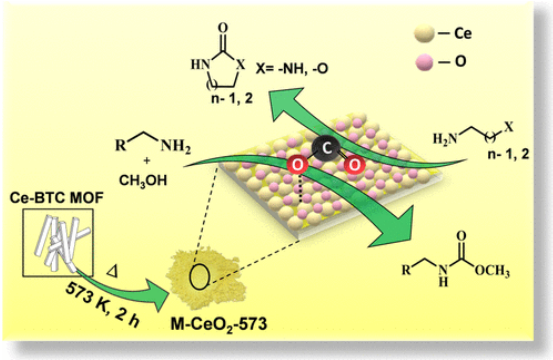
Graphical Abstract:



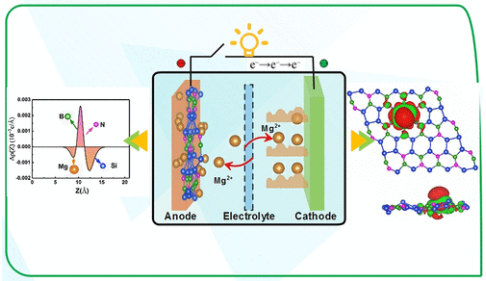
17. [EcTracker: Tracking and elucidating ectopic expression leveraging large-scale scRNA-seq studies]
V Gautam, A Mittal, S Kalra, SK Mohanty, K Gupta…S Naidu… - Briefings in Bioinformatics, 2021

Abstract: Dramatic genomic alterations, either inducible or in a pathological state, dismantle the core regulatory networks, leading to the activation of normally silent genes. Despite possessing immense therapeutic potential, accurate detection of these transcripts is an ever-challenging task, as it requires prior knowledge of the physiological gene expression levels. Here, we introduce EcTracker, an R-/Shiny-based single-cell data analysis web server that bestows a plethora of functionalities that collectively enable the quantitative and qualitative assessments of bona fide cell types or tissue-specific transcripts and, conversely, the ectopically expressed genes in the single-cell ribonucleic acid sequencing datasets. Moreover, it also allows regulon analysis to identify the key transcriptional factors regulating the user-selected gene signatures. To demonstrate the EcTracker functionality, we reanalyzed the CRISPR interference (CRISPRi) dataset of the human embryonic stem cells differentiated into endoderm lineage and identified the prominent enrichment of a specific gene signature in the SMAD2 knockout cells whose identity was ambiguous in the original study. The key distinguishing features of EcTracker lie within its processing speed, availability of multiple add-on modules, interactive graphical user interface and comprehensiveness. In summary, EcTracker provides an easy-to-perform, integrative and end-to-end single-cell data analysis platform that allows decoding of cellular identities, identification of ectopically expressed genes and their regulatory networks, and therefore, collectively imparts a

	novel dimension for analyzing single-cell datasets.
18.	Effect of Particle Size and Morphology on Critical Velocity and Deformation Behavior in Cold Spraying L Palodhi, B Das, H Singh - Journal of Materials Engineering and Performance, 2021 **Abstract:** Experimental investigations, coupled with numerical simulations, reported in the literature have documented the effect of particle size quite systematically. However, similar systematic studies on the role of particle morphology are lacking in the literature, although numerous experiments suggest a qualitative dependence of the coating process on the morphology. In this paper, we attempt to address the lacunae by comparing the deformation behavior and critical velocity by systematically varying the particle morphology and size. We have considered two different shapes, viz., spherical particles (where the size has been varied) and conical particles (where the morphology has been varied as a function of the apical angle, in addition to varying the size). Equi-volume comparison between the spherical particles and conical particles with different morphologies allow us to establish quantitative dependence of deformation characteristics and critical velocity on the particle morphology. We demonstrate that the vertices in conical shapes are regions of high stress concentration and deform preferentially; furthermore, the larger the apical angle the more closely does the deformation behavior of the conical particles resemble the sphere. Therefore, a knowledge of the distribution of particle size and morphology is expected to help tune and optimize the processing conditions.
19.	Effects of the COVID-19 pandemic on stock market returns and volatilities: evidence from selected emerging economies B Rakshit, Y Neog - Studies in Economics and Finance, 2021 **Abstract:** Purpose The purpose of this paper is to investigate the effects of exchange rate volatility, oil price return and COVID-19 cases on the stock market returns and volatility for selected emerging market economies. Additionally, this study compares the market performance in the emerging economies during the COVID-19 pandemic with the pre-COVID and global financial crisis (GFC) period. Design/methodology/approach The authors apply the arbitrage pricing theory to model the risk-return relationship between the risk-based factors (exchange rate volatility and COVID-19 cases) and stock market returns. By applying the exponential generalized autoregressive conditional heteroskedasticity model, the study captures the asymmetric volatility spillover from the stock markets to foreign exchange markets and vice versa. Findings Findings reveal that exchange rate volatility exerts a negative and significant effect on the market returns in Brazil (BOVESPA), Chile (S&P CLX IPSA), India (SENSEX), Mexico (S&P BMV IPC) and Russia (MOEX) during the coronavirus pandemic. Regarding the effect of oil price returns, the authors find a positive relationship between oil price and stock market returns across all the economies in the study. The market returns of Russia, India, Brazil and Peru appeared more volatile during the pandemic than the GFC period. Practical implications As the exchange rate volatility is causing higher risk and uncertainty in the stock market's performance, the central bank's effort to maintain a stabilizing effect on the exchange rate sale can be proven crucial for the economies under consideration. Emphasized should also be given to boost investors' confidence in the stock market, and for this, the government policy actions in reducing the transmission of the disease are the need of the hour. Originality/value While a large volume of literature on stock market performance in times of COVID-19 has emerged from developed economies, this study adds to the literature by exploring the emerging

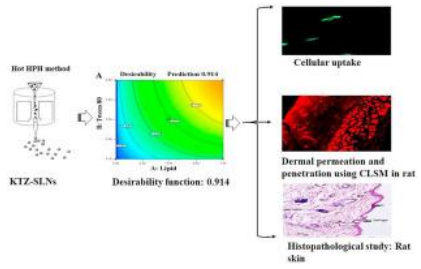
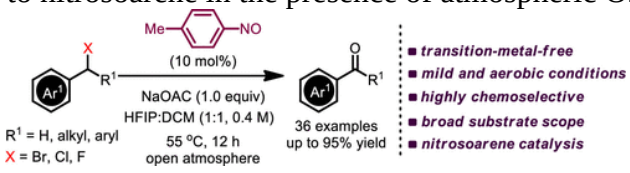
	economies' stock market performance during the COVID-19 pandemic. Unlike previous literature, this study examines the volatility spillover between stock and exchange rate markets in the worst affected emerging economies during the crisis.
20.	Efficient Activation of CO_2 over Ce-MOF-derived CeO_2 for the Synthesis of Cyclic Urea, Urethane, and Carbamate GS More, R Srivastava - Industrial & Engineering Chemistry Research, 2021 **Abstract:** The synthesis of various commodity chemicals like cyclic urea, urethanes, and carbamates via effective utilization of CO_2 has proved to be highly advantageous. Production of the chemicals mentioned above from CO_2 requires a complicated catalyst design and stringent reaction conditions. A simple catalyst possessing suitable sites that can effectively adsorb and activate CO_2 is required to synthesize these valuable chemicals. The catalyst should also have optimum acidity for amine adsorption to facilitate these reactions. This study demonstrates the synthesis of a highly efficient catalyst, Ce-BTC MOF-derived CeO_2, for CO_2 activation. Ce-BTC-MOF is synthesized and calcined to obtain Ce-BTC MOF-derived CeO_2. The presence of various facets and the oxygen vacancy required for CO_2 activation and adsorption is confirmed using Raman spectroscopy, X-ray photoelectron spectroscopy (XPS), and high-resolution transmission electron microscopy (HRTEM). CO_2 adsorption efficiency is evaluated using the adsorption experiments. The acidity and basicity of the catalyst are evaluated using the temperature-programmed desorption (TPD) analysis. Cyclic urea is produced by the reaction of diamine and CO_2 at low CO_2 pressure, while the CO_2 and amino alcohol reaction produce cyclic urethane. The reaction between CO_2 and primary amine produces carbamate. The calcination of Ce-BTC MOF at 573 K generates a CeO_2 catalyst, which offers an excellent activity for producing these chemicals. Ce-BTC MOF-derived CeO_2 exhibits efficient recyclability and stability. The developed ecofriendly and robust catalyst will be of significant scientific interest because it can be industrially deployed in producing these commercial synthetic intermediates. 
21.	Electric Field Dynamics in PILC Side of Dry Type MV Heat-shrink Transition Joints P Johri, C Chakradharreddy, K Chempak - IEEE Transactions on Power Delivery, 2021 **Abstract:** Frequent failures of transition joints were reported mainly near to the crutch area of the paper insulated cable side of the joints. In this paper, the authors present an estimation of the electric field and temperature distribution in the paper insulated cable side of a transition joint using simulations based on finite element method for 3-D geometry, which, apparently did not get much attention until now. It is found that non-linearities in material properties result in drastic changes in the distribution of electric field. The results indicate electric field enhancement near crutch area. The effect of varying load current, and ambient temperature on the peak electric field has been investigated. The simulations are validated analytically. The results are considered important for utilities and manufacturers.

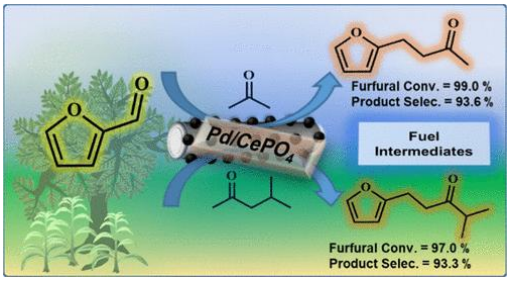
22.	Enhanced B (E 3) strength observed in ^{137}La MSR Laskar, R Palit, E Ideguchi, T Inakura, SN Mishra… D. Choudhury… - Physical Review C, 2021 **Abstract:** The ^{137}La nucleus was populated by the reaction ^{130}Te(^{11}B, 4n) at 40-MeV beam energy and the lifetime of the 11/2− state at 1004.6keV was measured using a hybrid array of HPGe clover and $LaBr_3$(Ce) detectors by electronic fast-timing technique, providing the value T1/2=263±12ps. The reduced transition probability B(E3)=23.3±2.4W.u. is found to be significantly larger compared to the values observed in lighter odd-A La isotopes. The experimentally determined B(E3) value is compared with theoretical calculations of random-phase approximation which explains the enhanced transition probability to be arising from higher contribution of the g9/2 orbital to the proton transition density.
23.	Enhancing the spontaneous emission using the structural resonances of self-assembled monolayers M Khokhar, S Sharma, SK Saini, RV Nair - Journal of Optics, 2021 **Abstract:** Self-assembled monolayers made using sub-micron dielectric spheres are analogous to atomic monolayers that have proven to be the modern workhorse in condensed matter physics. Here, we discuss the sub-micron dielectric monolayers which exhibit optical resonances, that are supported by the theory and simulations. These resonances are used to enhance the emission rate of quantum emitters such as nitrogen-vacancy (NV) centers in nanodiamonds. A two-fold enhancement in the emission intensity from NV centers is achieved over a broad wavelength range. The emission decay rate measurements confirm a 14% decrease in the excited state lifetime which implies an enhanced emission rate at the resonances. Our results provide a platform to tailor the light transport and emission for applications in photonics and quantum technologies using such monolayers.
24.	Experimental investigation of cyclic variation of heat release dynamics of HCCI combustion engine A Singh, RK Maurya - SAE Technical Paper, 2021 **Abstract:** Homogenous charge compression ignition (HCCI) combustion emerged as a promising technology for automotive pollution reduction. One of the major challenges for commercial application of HCCI combustion engine is to control the combustion in different engine operating conditions. To control HCCI ignition timing, it is often necessary to know the characteristics of HCCI cyclic variations. In this study, cyclic combustion variations in an HCCI engine are analyzed. Combustion stability and cycle-to-cycle variations of HCCI combustion parameters were investigated on a modified four-cylinder, four-stroke engine. The experiments were conducted by varying intake air temperatures and relative air-fuel ratios at different engine speeds. In the steady-state condition engine operation, in-cylinder pressure signals of 2000 consecutive engine combustion cycles are acquired for each test condition. From this large volume of experimental data collected, cyclic variations of various combustion parameters were analyzed. In this investigation cycle based time series analysis of heat release is analyzed by constructing a recurrence plot for different air-fuel ratios and intake air temperatures. In this study, probability plots are used to investigate the distribution of combustion parameters. The results show that the qualitative change in combustion can be easily related to patterns in recurrence plots.
25.	Exploring the Full Potential of Functional Si2BN Nanoribbons As Highly Reversible Anode Materials for Mg-Ion Battery P Panigrahi, Y Pal, R Ahuja, T Hussain - Energy & Fuels, 2021 **Abstract:** Efficient energy storage devices like rechargeable batteries have a vital role in the modern society to cater for an ever-increasing demand of energy. In this context, magnesium-ion batteries (MIBs) have emerged as high-capacity energy storage systems. However, the progress in this area is hindered due to the lack of suitable anode materials for efficient Mg^{2+} ion storage and diffusion. In this study, using state-of-the-art density functional theory (DFT) simulations, we have

	systematically investigated novel one-dimensional Si_2BN nanoribbons as anode materials for MIBs applications. Our calculations confirm the structural stability and metallic character of pristine (Si_2BN) and hydrogen functionalized (Si_2BN-H) nanoribbons upon Mg adsorptions. We find Mg adsorption energies in the ranges of −1.2 to −1.8 (−1.8 to −2.0) eV for 25% (20%) coverages in Si2BN (Si2BN-H), respectively, which are strong enough to mitigate the Mg aggregation. Maximum specific capacities of 661.865 (550.421) mAh g–1 and open-circuit voltages of 0.7–1.1 (0.6–0.8) V are found for Si_2BN (Si_2BN-H), respectively. Diffusion barrier calculations based on nudge elastic band (NEB) methods reveal a relatively low barrier of 0.14 eV, which guarantees a robust diffusion of Mg ions and faster charge/discharge capability of Si_2BN nanoribbons. These intriguing features confirm the potential of functional Si_2BN nanoribbons as promising anode materials for MIBs. 
26.	Faster Fog Computing based Over-the-air Vehicular Updates: A Transfer Learning Approach N Auluck, A Azim, A Singh, MA Maruf - IEEE Transactions on Services Computing, 2021 **Abstract:** Fog computing is a promising option for time sensitive vehicular over-the-air (OTA) updates, as it can offer enhanced network durability and lower communication delays, versus the cloud. Fog node utilization is non-deterministic, largely owing to vehicular traffic patterns. The resultant over provisioning of resources manifests itself in increased communication and handover delays. Based on an analysis of regional traffic patterns, our proposed algorithm determines the optimal number of fog nodes required for OTA updates. The efficacy of our proposed approach is demonstrated using a case study that considers handover delay, propagation delay, transmission rate and vehicular mobility to predict the OTA update time. We employ a machine learning model for predicting the communication delay between fog devices and vehicles. Using European WiFi hotspot signal strength NYC dataset and 5G dataset, we observe that the proposed approach increases net reserve fog resources by 26.57% on average, and reduces the OTA update time by 5.34%. We test the scalability of our approach by analyzing the performance in terms of average throughput while varying the number of vehicles and OTA update size. The performance of the proposed OTA update scheme on simulations has been corroborated by implementation on a real-world testbed.
27.	Generalized seniority isomers in and around Z= 82 closed shell: A survey of Hg, Pb and Po isotopes B Maheshwari, D Choudhury, AK Jain - Nuclear Physics A, 2021 **Abstract:** In this paper, we investigate the generalized seniority scheme and the validity of Generalized Seniority Schmidt Model in and around the Z=82 semi-magic region. A consistently same multi-j configuration is used to explain all the nuclear spectroscopic properties such as *g*–factors, *Q*–moments and B(E2) trends for the $13/2^+$, 12^+ and $33/2^+$ isomers in all the three Hg, Pb and Po isotopic chains. The inverted parabolic B(E2) trends for the first 2^+ states in Hg, Pb and Po isotopes are also explained using the generalized seniority scheme. A comparison with the experimental data is presented, wherever possible, and future possibilities are suggested.

28.	Graph Based Training Resource Allocation Scheme for CoMP Transmission in CRAN: A Low Complexity Solution R Singh, D Saluja, S Kumar - IEEE Transactions on Network Science and Engineering, 2021 **Abstract:** Coordinated Multi Point (CoMP) transmission in Cloud Radio Area Network (CRAN) strives to provide the required Quality of Service (QoS), irrespective of user's location. Specifically, CoMP enables intra-cluster Access Points (APs) to maximize user's performance utilizing channel information, which is obtained by exchanging prior-known pilot signals among the intended users and intra-cluster APs. These signals are often referred as training signals, and are shared over Training Resources (TRs). However, CoMP is pillared on user-centric network, thereby the resulting clusters are inevitably overlapped. As a result, the TR allocation schemes for these networks require considerably large computational complexity. In this paper, we introduce the notion of Time Slot Tagging (TST), in which each AP is tagged with an appropriate training slot. Further, clusters are formed on the basis of this tagged information. Specifically, TST eliminates the requirement of resource allocation for individual users which saves a significant time in each clustering cycle, and thus enhances the link utilization factor. Also, TST is designed in a manner that it assures the presence of preferred APs in each intended cluster. Further, it is shown that the proposed approach performs significantly close to the most optimistic scenario.
29.	Infrared non-destructive testing and evaluation for inspection of carbon fiber reinforced polymer materials R Mulaveesala, A Rani, V Kher, P Mishra, J Kaur - Proceedings Volume 11743, Thermosense: Thermal Infrared Applications XLIII, 2021 **Abstract:** Infrared non-destructive testing and evaluation is one of the most promising inspection methods for evaluating variety of materials due to its merits such as remote based, whole field, safe and quantitative inspection capabilities. Among the various infrared non-destructive evaluation methods, pulse based thermography and mono frequency excited modulated lock-in thermography gained importance due to their simple experimentation procedure and data processing approaches involved. However, recently proposed matched filter based non-periodic infrared thermographic approaches gained importance due to their superior sub-surface defect identification capabilities in terms of detection resolution and sensitivity. The present work demonstrates the merits of pulse compression favorable thermal wave imaging approach for identification of flat bottom holes in a carbon fiber reinforced polymer material.
30.	Irreversible Electroporation as an Alternative to Wound Debridement Surgery B Das, F Berthiaume - Surgical Technology International, 2021 **Abstract:** Debridement is a standard part of wound care that is used on both acute and chronic wounds. Current methods of wound debridement include: autolytic based on the natural immune response, surgical, enzymatic based on application of exogenous proteases, mechanical using water jets and ultrasound, and biological using live organisms such as maggots. The choice of individual methods involves a trade-off between speed of treatment, selectivity, and pain. Irreversible electroporation via the application of pulsed electric fields has been used as a novel approach for deep tissue ablation, sometimes in conjunction with chemotherapy, as in the case of tumors, and also in cases where high precision is needed in otherwise very fragile tissues, such as for treating diabetic neuropathy and in epicardial atrial ablation. This method could be readily extended to wound care as it is both rapid and relatively painless, and it is also effective at decreasing bacterial load and clearing biofilms. Furthermore, the process primarily targets cells leaving the extracellular matrix relatively intact, thus providing a suitable natural scaffold for host cellular invasion and regrowth. A unique aspect of the use of pulsed electric fields is that around the region where ablation is perfomed, electric fields of lower energy are dissipated into the healthy tissue. There is a range of electric fields that are known to stimulate cellular functions, in particular migration and proliferation, and that may contribute to the healing process after electroporation. While

	irreversible electroporation is a potentially useful alternative to other debridement methods, future clinical application awaits technological advances in electrode design that will enable precise delivery of the therapy in wounds of various sizes and depths.
31.	Knowledge-Based Neural Networks for Fast Design Space Exploration of Hybrid Copper-Graphene On-Chip Interconnect Networks R Kumar, SSL Narayan, S Kumar, S Roy, BK Kaushik… R Sharma - IEEE Transactions on Electromagnetic Compatibility, 2021 **Abstract:** In this article, an artificial neural network (ANN) is developed in order to predict the per-unit-length (p. u. l.) parameters of hybrid copper-graphene on-chip interconnects from a prior knowledge of their structural geometry and layout. The salient feature of the proposed ANN is that it combines knowledge of the p. u. l. parameters extracted from empirical models along with that extracted from a rigorous full-wave electromagnetic solver. As a result, the proposed ANN is referred to as a knowledge-based neural network (KBNN). The KBNN has been found to converge to the same accuracy as a conventional ANN but at the expense of far smaller training time costs. As a result, the KBNN is much more suitable for performing design space explorations.
32.	Machine Learning Models for Drowsiness Detection H Meda, JMP Ganesh, A Sahani - IEEE International Instrumentation and Measurement Technology Conference, 2021 **Abstract:** Road crashes and other accidents have become the common cause of fatalities and injuries in the human world. According to data from the World Health Organisation (WHO) in 2015, nearly 1.25 million people died worldwide due to road accidents. Driver fatigue is a significant factor in many road accidents. A sleepy driver is more dangerous than a driver driving at high speeds as he is victim of less sleep. Many researchers and manufactures are trying to solve this using various technologies. Driver drowsiness detection can help prevent a huge number of sleep induced road accidents. We will be using computer vision algorithms to extract facial features such as eye closure and yawning, followed by machine learning techniques to effectively detect driver state. We will be comparing multiple machine learning models and will be using the most effective one to develop a real-time drowsiness detector. This system will warn the driver if it detects a drowsy state, hence preventing any harm that may have been caused to the driver and the passengers otherwise.
33.	Mechanistic evaluations of ketoconazole lipidic nanoparticles for improved efficacy, enhanced topical penetration, cellular uptake (L929 and J774A. 1), and safety assessment: In vitro and in vivo studies M Ramzan, G Kaur, S Trehan, JN Agrewala… - Journal of Drug Delivery Science and Technology, 2021 **Abstract:** Ketoconazole (KTZ) is a potential antifungal drug to control resistant and recurring opportunistic fungal infections. The study aimed to prepare KTZ loaded solid lipid nanoparticles (KTZ−SLNs) by high pressure homogenization method followed by optimization using Design Expert software and characterization for particle size, polydispersity index (PDI), zeta potential, morphology, in-vitro antifungal activity (susceptible and resistant strains), in-vitro cellular uptake (L929 and J774A.1 cell lines) and in-vitro hemolysis. Cellular uptake studies using dermal fibroblasts and Candida albicans were carried out with rhodamine B (RhB) and fluorescein isothiocyanate (FITC) labelled SLNs. Finally, acute skin irritation (EpiDerm™ and rabbit skin) and histological assessments were performed to confirm safety concern. Results showed that the optimized spherical KTZ-SLN4 exhibited mean size of 292 ± 6.3 nm, optimal zeta potential (−24.39) and SPAN value of 2.0. In-vitro antifungal efficacy of KTZ-SLN4 exhibited 75–95% and 50–75% reduction in MIC (minimum inhibitory concentration) value as compared to the free drug suspension (KTZ-SUS) and marketed product (KTZ-MKT), respectively. In-vitro hemolysis confirmed the biocompatibility at explored concentration. Developed SLNs exhibited significant

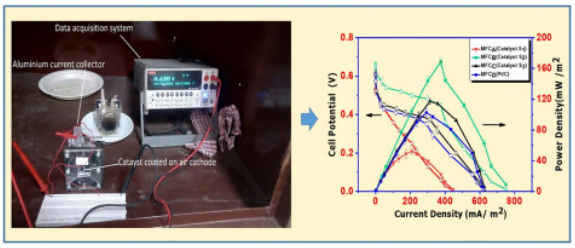
	($p < 0.05$) cellular internalization both by dermal fibroblasts (site of infection) and Candida albicans. Furthermore, rhodamine probed SLNs (RhB-SLN4) showed 12.6 fold higher penetration up to dermal region of skin as evidenced with confocal laser scanning microscopy (CLSM). Thus, KTZ-SLN4 demonstrated hemocompatibility, substantial penetration into rat skin, and improved efficacy against fungal strains. Conclusively, KTZ-SLNs can be a promising alternative to conventional formulations with significant clinical impact to control menace of fungal resistance and recurrence. **Graphical Abstract:** 
34.	Motion and region aware adversarial learning for fall detection with thermal imaging V Mehta, A Dhall, S Pal, SS Khan - 25th International Conference on Pattern Recognition, 2021 **Abstract:** Automatic fall detection is a vital technology for ensuring the health and safety of people. Home-based camera systems for fall detection often put people's privacy at risk. Thermal cameras can partially or fully obfuscate facial features, thus preserving the privacy of a person. Another challenge is the less occurrence of falls in comparison to the normal activities of daily living. As fall occurs rarely, it is non-trivial to learn algorithms due to class imbalance. To handle these problems, we formulate fall detection as an anomaly detection within an adversarial framework using thermal imaging. We present a novel adversarial network that comprises of two-channel 3D convolutional autoencoders which reconstructs the thermal data and the optical flow input sequences respectively. We introduce a technique to track the region of interest, a region-based difference constraint, and a joint discriminator to compute the reconstruction error. A larger reconstruction error indicates the occurrence of a fall. The experiments on a publicly available thermal fall dataset show the superior results obtained compared to the standard baseline.
35.	Nitrosoarene-Catalyzed HFIP-Assisted Transformation of Arylmethyl Halides to Aromatic Carbonyls under Aerobic Conditions S Pradhan, V Sharma, I Chatterjee - Organic Letters, 2021 **Abstract:** A rare metal-free nucleophilic nitrosoarene catalysis accompanied by highly hydrogen-bond-donor (HBD) solvent, 1,1,1,3,3,3-hexafluoro-2-propanol (HFIP), organocatalytically converts arylmethyl halides to aromatic carbonyls. This protocol offers an effective means to access a diverse array of aromatic carbonyls with good chemoselectivity under mild reaction conditions. The activation of arylmethyl halides by HFIP to generate stable carbocation and autoxidation of in situ generated hydroxylamine to nitrosoarene in the presence of atmospheric O2 are the keys to success. 
36.	On the Petersson inner products of Fourier–Jacobi coefficients and Hecke eigenvalues of Siegel cusp forms B Kumar, B Paul - Acta Arithmetica, 2021 **Abstract:** Let *F* and *G* be Siegel cusp forms of weight *k* and degree *n*>1 with Fourier–Jacobi

	coefficients fm and gm respectively for all $m \in \mathbb{N}$. Assume that the Petersson inner products $\langle fm, gm \rangle$ are real for all $m \in \mathbb{N}$. We prove that if $\langle F, G \rangle = 0$ and not all $\langle fm, gm \rangle$ are zero, the sequence $\{\langle fm, gm \rangle\}_{m \in \mathbb{N}}$ changes sign infinitely often. When $\langle F, G \rangle \neq 0$, we show that $\lvert\langle fm, gm \rangle\rvert > cm^{k-1}$ for infinitely many $m \in \mathbb{N}$, where $c > 0$ is a constant depending on F and G. This generalizes a result of Kohnen. We also investigate similar properties of these Petersson inner products in arithmetic progressions. In this case, our results strengthen a result of Gun and Kumar. Finally, we study simultaneous non-vanishing of the Hecke eigenvalues of Siegel cusp forms of degree 2.
37.	Pd-Decorated CePO4 Catalyst for the One-Pot, Two-Step Cascade Reaction to Transform Biomass-Derived Furanic Aldehydes into Fuel Intermediates A Kumar, R Bal, R Srivastava - Energy & Fuels, 2021 **Abstract:** Production of fuel range chemicals from biomass-derived carbonyls is a viable strategy to overcome the dependency on nonrenewable fossil fuels. Acid–base catalytic processes play a vital role in producing liquid fuel range chemicals and intermediates derived from renewable biomass. Aldol condensation is one of the simplest ways to convert biomass-derived carbonyls to C8–C15 range fuels. Herein, $CePO_4$ possessing acidic and basic sites is synthesized under basic pH and used as catalyst support to decorate Pd nanoparticles to fabricate a $Pd/CePO_4$ catalyst. $Pd/CePO_4$ facilitates aldol condensation to form a highly selective α,β-unsaturated methyl ketone in the first step, followed by the selective reduction of C═C to form a C–C coupled hydrogenated product containing a C═O functional group in a one-pot cascade protocol. Many biomass and non-biomass-derived aldehydes are reacted with acetone and methyl isobutyl ketone (MIBK) for the selective production of fuel precursors. Pyridine Fourier transform infrared (FT-IR) and NH_3/CO_2 temperature-programmed desorption (TPD) measurements are employed to probe the acidity and basicity of the catalyst. The influence of different Pd loadings on the reducibility of these catalysts is studied by H_2 temperature-programmed reduction (TPR) analysis. The activation energy (E_a) for aldol condensation between furfural and acetone is estimated to be 55.3 kJ/mol. The present catalytic system offers a higher furfural conversion (99.0%) with a higher selectivity (93.6%) of the desired hydrogenated product. Production of furan-based higher-carbon-containing compounds having carbonyl functionality using a simple and robust metal phosphate-based catalyst would be highly interesting from industrial and academic perspectives for fuel/chemical production. 
38.	Potential SiX (X= N, P, As, Sb, Bi) homo-bilayers for visible-light photocatalysts application R Somaiya, D Singh, YK Sonvane, SK Gupta, R Ahuja - Catalysis Science & Technology, 2021 **Abstract:** It is a challenge to identify suitable low-dimensional materials as photocatalysts for photocatalytic water splitting applications. We have systematically investigated SiN, SiP, and SiAs homo-bilayers that are efficient for water splitting applications, and studied five different possible stacking configurations for these homo-bilayers. Our phonon dispersion curve analysis indicates the dynamical stability of odd stackings for all the studied bilayers. The electronic band structures of these stable stackings of SiX homo-bilayers were studied using GGA-PBE and hybrid HSE06 functional. All the studied systems are semiconductors with electronic bandgaps in the range of 2.488–0.948 eV with the hybrid HSE06 functional. Ultrahigh carrier mobilities of the order of 106 cm2 V−1 s−1 have been predicted. SiBi (S-I) indicated the highest carrier mobility of 18.1 × 106

	cm2 V−1 s−1 for electrons along the x-direction. Most impressively, we found that the band edge potentials of SiP and SiAs straddle the oxidation and reduction potentials in photocatalytic water splitting. It was observed that only SiN satisfied the oxidation conditions, whereas SiSb and SiBi satisfied the reduction conditions in water splitting. An excellent optical absorption was obtained for SiN, SiP, and SiAs homo-bilayers in the visible region, indicating their potential in photocatalytic water splitting. Further, the electrocatalytic activity towards OER/ORR was investigated using first-principles calculations. The thermoelectric figure of merit was explored, and the highest value of 1.02 was obtained for the SiSb monolayer. Our results indicate that Si-based homo-bilayers display promising potential for visible-light-driven photocatalytic water splitting and thermoelectric applications.
39.	Recovery of high purity chlorine by Cu-doped Fe2O3 in nitrogen containing carbon matrix: A bifunctional electrocatalyst for HCl electrolysis D Gupta, A Kafle, A Chaturvedi, T C. Nagaiah – ChemElectroChem **Abstract:** An environmental benign approach towards synthesis of a non-noble metal and/or metal oxide doped incorporated in nitrogen containing carbon matrix (Cu-Fe2O3/NC) is premeditated in this study. In situ incorporation of Cu, Fe2O3 as well as nitrogen into the carbon matrix using a single gel precursor simplified the synthetic route and divulged bifunctional activity assisting chlorine evolution at anode and oxygen reduction reaction at cathodic counterpart during HCl electrolysis. As a result of synergy between Cu and Fe2O3 in N- doped carbon matrix, enhanced activity and stability is stimulated. Catalyst optimization was executed by varying the weight percentage of metal reactants added during precursor synthesis (2, 5 and 10 wt. %), which rendered different composition of Cu, Fe2O3 and N in the composite as well as different morphology at same thermal treatment conditions. Electrochemical studies were performed 0.4 M HCl analogous to industrial waste HCl, to investigate the bifunctional activity of catalyst where Cu-Fe2O3 (5%)/NC came out to be the most active and exhibited long term stability for 24 hours at onset potential of chlorine evolution. It offered a higher current density of 92.1 mA cm-2 at 1.7 V vs. RHE during chlorine evolution and comparable activity to that of benchmark noble metal based catalyst along with more positive onset potential and high diffusion limiting current density of 0.75 V vs. RHE and 6 mA cm-2 during oxygen reduction respectively.
40.	Role of atomicity in the oxygen reduction reaction activity of platinum sub nanometer clusters: A global optimization study AS Nair, A Anoop, R Ahuja, B Pathak - Journal of Computational Chemistry **Abstract:** Metal nanoclusters are an important class of materials for catalytic applications. Sub nanometer clusters are relatively less explored for their catalytic activity on account of undercoordinated surface structure. Taking this into account, we studied platinum-based sub nanometer clusters for their catalytic activity for oxygen reduction reaction (ORR). A comprehensive analysis with global optimization is carried out for structural prediction of the platinum clusters. The energetic and electronic properties of interactions of clusters with reaction intermediates are investigated. The role of structural sensitivity in the dynamics of clusters is unraveled, and unique intermediate specific interactions are identified. ORR energetics is examined, and exceptional activity for sub nanometer clusters are observed. An inverse size versus activity relationship is identified, challenging the conventional trends followed by larger nanoclusters. The principal role of atomicity in governing the catalytic activity of nanoclusters is illustrated. The structural norms governing the sub nanometer cluster activity are shown to be markedly different from larger nanoclusters.
41.	Smart strategy of butterfly wing scales to control the light diffusion and absorption SK Saini, S Sharma, N Singh, M Khokhar, RV Nair - Journal of the Optical Society of America B, 2021 **Abstract:** The sparkling colors on the wing scales of butterflies are one of the most fascinating

	light–matter interactions in nature and have been an intense area of research in recent times. Controlling the light diffusion and absorption due to multiple scattering induced by the inherent disorder in the wing scales is required for applications in imaging, light trapping, and localization using such bio-inspired photonic structures. Here, we study the selective anisotropic light diffusion and absorption in the nanoarchitectures of Pieris rapae and Graphium sarpedon butterfly wing scales in the visible range. We have measured broadband spatially independent low values of specular reflectivity and ballistic transmission from the ventral and the dorsal sides of the wing scales, which are supported with finite-difference time-domain simulations. The specular reflectivity value as small as 3% indicates strong diffuse scattering within the scales, probed using total transmission and reflection measurements. We have found finite wavelength-dependent absorption <100% in these wing scales. Further, we have obtained negative scattering anisotropy (g) values from the dorsal side, whereas it is positive from the ventral side for both butterflies. The negative g value originating due to the inherent structural correlation is differentiated from that arising due to pigment absorption. The results are useful for generating the optimized light scattering in bio-inspired photonic devices.
42.	Spatial network based model forecasting transmission and control of COVID-19 N Sharma, AK Verma, AK Gupta - Physica A: Statistical Mechanics and its Applications, 2021 **Abstract:** The SARS-CoV-2 driven infectious novel coronavirus disease (COVID-19) has been declared a pandemic by its brutal impact on the world in terms of loss on human life, health, economy, and other crucial resources. To explore more about its aspects, we adopted the SEIRD (Susceptible–Exposed–Infected–Recovered–Death) pandemic spread with a time delay on the heterogeneous population and geography in this work. Focusing on the spatial heterogeneity, epidemic spread on the framework of modeling that incorporates population movement within and across the boundaries is studied. The entire population of interest in a region is divided into small distinct geographical sub regions, which interact using migration networks across boundaries. Utilizing the time delay differential equations based model estimations, we analyzed the spread dynamics of disease in India. The numerical outcomes from the model are validated using real time available data for COVID-19 cases. Based on the developed model in the framework of the recent data, we verified total infection cases in India considering the effect of nationwide lockdown at the onset of the pandemic and its unlocking by what seemed to be the end of the first wave. We have forecasted the total number of infection cases in two extreme situations of nationwide no lockdown and strict lockdown scenario. We expect that in future for any change in the key parameters, due to the regional differences, predictions will lie within the bounds of the above mentioned extreme plots. We computed the approximate peak infection in forwarding time and relative timespan when disease outspread halts. The most crucial parameter, the time-dependent generalization of the basic reproduction number, has been estimated. The impact of the social distancing and restricted movement measures that are crucial to contain the pandemic spread has been extensively studied by considering no lockdown scenario. Our model suggests that attaining a reduction in the contact rate between susceptible and infected individuals by practicing strict social distancing is one of the most effective control measures to manage COVID-19 spread in India. The cases can further decrease if social distancing is followed in conjunction with restricted movement.
43.	Spread Spectrum Coded Radar for R2R Interference Mitigation in Autonomous Vehicles R Singh, D Saluja, S Kumar - IEEE Transactions on Intelligent Transportation Systems, 2021 **Abstract:** Autonomous Vehicles (AVs) rely on a set of radar sensors operated on frequency modulated waveforms. Due to the large bandwidth requirement of frequency modulated radars, only a limited number of proximate vehicles can be allowed for a concurrent transmission within the available spectrum. However, with the explosive growth of AVs, the available spectrum may soon reach its capacity. As a results, the coexistence of multiple AVs working on same resource, may lead to the problem of Radar-to-Radar (R2R) interference, also known as radar blindness. In this paper, we propose the notion of coded waveforms to minimize the R2R interference among the

	vehicles operating on the same resource. Specifically, the spread spectrum codes have been used as another degree of freedom (i.e., along with time-frequency resources) to spread the inter-vehicular radar interference over the wider spectrum, which enable to orthogonalize more number of AVs over the available range of spectrum. In addition, we have formulated a Spread Spectrum-based Radar Transmission Scheme (SS-RTS), and described the transmission and reception through SS-RTS. Also, the SS-RTS has been compared with the existing Graph-based Resource Allocation (GRA) scheme. Further, simulation results verified that SS-RTS significantly reduces the inter-vehicular R2R interference and outperforms GRA in terms of blind probability.
44.	Substituted 2D Janus WSSe monolayers as efficient nanosensor toward toxic gases S Pal Kaur, T Hussain, TJ Dhilip Kumar - Journal of Applied Physics, 2021 **Abstract:** The presence of inherent strain and electric field in the Janus transition metal dichalcogenide nanosheets widens their applications in nanodevices. The weak interactions between pristine Janus monolayers and gas molecules limit the applications of Janus sheets in gas sensing devices. However, tuning of structural and electronic properties by doping of foreign atoms in the lattice structure improves the gas sensing property of Janus WSSe monolayers. Herein, the superior gas sensing property of N, P, and As doped Janus WSSe monolayers for CO, NO, and HF gases has been studied using spin-polarized density functional theory. The binding energy analysis shows that the 3.12% doping of N, P, and As at S/Se sites is an exothermic process. New bands have been observed near the Fermi region in doped nanosheets. The simulations also reveal that doping improves the gas sensing properties of the doped sheets because of strong interactions between adsorbate and adsorbent. The interactions between gas molecules and doped WSSe monolayers are examined with the help of density of states plots. The uni-axial tensile strain tends to further improve the adsorption of CO on the nitrogen-doped WSSe nanosheet. Based on the present studies, it is evident that only 3.12% doping of foreign atoms makes WSSe Janus monolayers efficient material for CO, NO, and HF gas sensing without imposing external strain.
45.	Sulfonic acid functionalized graphitic carbon nitride as solid acid–base bifunctional catalyst for Knoevenagel condensation and multicomponent tandem reactions P Choudhary, A Sen, A Kumar, S Dhingra, CM Nagaraja… - Materials Chemistry Frontiers, 2021 **Abstract:** Rational design and development of acid–base bifunctional heterogeneous catalysts for organic synthesis is a tough process. A highly efficient, non-toxic, metal-free, low-cost, acid–base bifunctional sulfonated graphitic carbon nitride (S-g-C_3N_4) catalyst has been developed. The as-synthesized S-g-C_3N_4 catalyst exhibits high catalytic potential towards Knoevenagel condensation and sequential tandem reactions. The as-synthesized catalyst was developed by sulfonation of graphitic carbon nitride (g-C_3N_4). The sulfonation leads to surface functionalization of –SO_3H groups onto the catalyst surface. These –SO_3H groups impart acidic nature to the S-g-C3N4 catalyst along with the preexisting basic nature of the catalyst due to the presence of N-containing moieties. These dual acid–base functionalities behave as active sites for the sequential catalytic reactions to occur. The S-g-C_3N_4 catalyst exhibits high turnover numbers (TON) and high yields in shorter reaction time at optimum conditions of temperature which demonstrates the high catalytic activity of the S-g-C_3N_4 nanosheets. The corresponding green metrics parameters were also calculated, in addition to demonstrating the excellent catalyst recyclability and reusability. The as-synthesized S-g-C_3N_4 catalyst provides a metal-free, sustainable and green approach for utilizing acid–base bifunctional catalysts for sequential organic synthesis.
46.	Supersymmetric graphene on squashed hemisphere RK Gupta, A Ray, K Sil - Journal of High Energy Physics, 2021 **Abstract:** We compute the partition function of N = 2 supersymmetric mixed dimensional QED on a squashed hemisphere using localization. Mixed dimensional QED is an abelian gauge theory coupled to charged matter fields at the boundary. The partition function is a function of the complex gauge coupling τ, the choice of R-symmetry and the squashing deformation. The

	superconformal R-symmetry is determined using the 3-dimensional F-maximization. The free energy as a function of squashing deformation allows computing correlation functions that contain the insertion of the energy-momentum tensor. We compute the 2-point correlation function of the energy-momentum tensor of 3-dimensional theory by differentiating the free energy with respect to the squashing parameter. We comment on the behaviour of the 2-point function as we change the complex coupling τ.
47.	Synthesis of Co/Ni @ Al_2O_3-GO as novel oxygen reduction electrocatalyst for sustainable bioelectricity production in single-chambered microbial fuel cells A Chaturvedi, A Chaturvedi, TC Nagaiah… - Journal of Environmental Chemical Engineering, 2021 **Abstract:** In this work, the synthesis of cobalt (Co) -nickel (Ni) nanoparticles supported on the matrix of alumina-graphene oxide (Al_2O_3-GO) and studies of their oxygen reduction reaction (ORR) activity in single-chambered microbial fuel cells (MFCs) were reported. A study of different weight ratios of Co-Ni nanoparticles with support material is accomplished to determine the catalyst performance. It is revealed that the catalyst Co-Ni (2:1)/Al_2O_3-GO (catalyst S_2) with a weight ratio of 2:1 of nanoparticles shows optimized properties among other electrocatalysts. The ORR study of hybrid catalysts suggested that the catalyst S_2 (reduction potential at 542 mV with −0.252 mA current) showed higher stability and electrocatalytic activities compared to catalyst Pt/C (reduction potential at 466 mV with −0.210 mA current) towards ORR. Al_2O_3-GO supported Co-Ni (2:1) catalyst revealed an improved ORR rate in single-chambered MFCs with a maximum power density of ~168 mW/m^2 compared to 102 mW/m^2 for Pt/C. The enhanced electrocatalytic activity of catalyst S_2 was accredited to the high electronic conductivity and longer stability of the nanocomposite. MFC_B (catalyst S_2) showed the highest OCV values (668 ± 15 mV), corresponding to the maximum electrochemical activity. Higher OCV values signified a stable biofilm developed on anode surface resulting in high electron transfer from microbes to anode surface, leading to maximum power production by catalyst S_2 in MFC_B. The experimental consequences confirmed the employments of Al_2O_3-GO as a beneficial support matrix in constructing inexpensive and efficient cathode catalysts over standard Pt/C catalysts for single-chambered MFCs. **Graphical Abstract:** 
48.	Temporal-Spatial-Energy resolved advance multidimensional techniques to probe photovoltaic materials from atomistic viewpoint for next-generation energy solutions V Kumar, M Kumar - Energy & Environmental Science, 2021 **Abstract:** Solar cell technologies have attracted great attention in view of their potential to meet world's energy demands in sustainable fashion. Extensive research efforts have been made to increase the efficiency of conventional and newly developed photovoltaic (PV) materials, while looking for new candidates to maximize solar conversion efficiencies. In this direction, advanced characterization tools capable of analysing material properties multi-dimensionally are being continuously developed, enabling researchers to fundamentally understand various aspects of material properties. This has equipped researchers with various tools to engineer the structural, morphological, electrical, chemical and optical properties altogether, to improve device performance. Herein, we have covered recent advances in developing multidimensional

	characterization tools, capable of probing material properties with high spatial, energy and temporal resolutions altogether. Numerous advantages associated with mapping material properties under in-situ/operando conditions to unveil various aspects of material properties in parallel are disclosed. In addition, integration of various characterization tools to visualize the evolution of carrier dynamics under the influence of various external stimuli have been discussed in detail. Along with discussing the advantages of multidimensional mapping tools over conventional tools, various outlooks for realizing next-generation characterization tools have been provided to facilitate the commercialization and development of next-generation solar cell modules.
49.	Towards Enhanced System Efficiency while Mitigating Row Hammer K Goswami, DS Banerjee, S Das - ACM Transactions on Architecture and Code Optimization, 2021 **Abstract:** In recent years, DRAM-based main memories have become susceptible to the Row Hammer (RH) problem, which causes bits to flip in a row without accessing them directly. Frequent activation of a row, called an aggressor row, causes its adjacent rows' (victim) bits to flip. The state-of-the-art solution is to refresh the victim rows explicitly to prevent bit flipping. There have been several proposals made to detect RH attacks. These include both probabilistic as well as deterministic counter-based methods. The technique of handling RH attacks, however, remains the same. In this work, we propose an efficient technique for handling the RH problem. We show that the mechanism is agnostic of the detection mechanism. Our RH handling technique omits the necessity of refreshing the victim rows. Instead, we use a small non-volatile Spin-Transfer Torque Magnetic Random Access Memory (STTRAM) that ensures no unnecessary refreshes of the victim rows on the DRAM device and thus allowing more time for normal applications in the same DRAM device. Our model relies on the migration of the aggressor rows. This accounts for removing blocking of the DRAM operations due to the refreshing of victim rows incurred in the previous solution. After extensive evaluation, we found that, compared to the conventional RH mitigation techniques, our model minimizes the blocking time of the memory that is imposed due to explicit refreshing by an average of 80.72% in the worst-case scenario and provides energy savings of about 15.82% on average, across different types of RH-based workloads. A lookup table is necessary to pinpoint the location of a particular row, which, when combined with the STTMRAM, limits the storage overhead to 0.39% of a 2 GB DRAM. Our proposed model prevents repeated refreshing of the same victim rows in different refreshing windows on the DRAM device and leads to an efficient RH handling technique.
50.	TRAP: Traffic-Based Adaptive Ramp Packing for Blind Cancellation in Autonomous Vehicles R Singh, D Saluja, S Kumar - IEEE Transactions on Intelligent Transportation Systems, 2021 **Abstract:** Autonomous Vehicles (AVs) rely on a set of radar sensors used to map surrounding environment. Most commonly used radar sensors for AVs use Frequency Modulated Continuous Wave (FMCW) ramps for object parameter (i.e., range and relative velocity) estimation. Due to large bandwidth requirement of FMCW radar, only a limited number of AVs can be operated in the available spectrum. Consequently, the co-existence of large number of AVs may lead to the problem of radar-to-radar interference, also referred to as radar blindness. Moreover, the problem becomes more severe in the higher traffic scenarios. In this work, we propose a Traffic-based Adaptive Ramp Packing (TRAP) scheme, which adapts radar range and assigns FMCW ramp parameters on the basis of inter-vehicular distance among AVs. Specifically, TRAP scheme allows to make effective use of the available time-frequency resource, and enables to pack more ramps in the dense traffic scenarios. Further, it is shown that adaptive radar range adoption may provide significantly more number of ramps in the given bandwidth. Furthermore, through simulation results, it is shown that TRAP significantly reduces the blind probability against state-of-the-art fixed range schemes.

51.

Two-dimensional Janus Sn_2SSe and $SnGeS_2$ semiconductors as strong absorber candidates for photovoltaic solar cells: First principles computations

I Bouziani, M Kibbou, Z Haman, N Khossossi…R.Ahuja - Physica E: Low-dimensional Systems and Nanostructures, 2021

Abstract: Two-dimensional materials provide new opportunities for the next generation of effective and ultrathin photovoltaic solar cells. Herein, we propose Janus monolayers of Tin monochalcogenides, especially Janus Sn_2SSe (type TA) and $SnGeS_2$ (type TB) nanosheets, as strong absorber candidates for solar energy conversion, referring to their excellent electronic and optical properties. Interestingly, based on the first-principles computations, both Janus Sn_2SSe and $SnGeS_2$ monolayers possess semiconductor character with indirect and moderate band gaps of 1.60 and 1.61eV, respectively. Accordingly, the considered systems, Sn_2SSe and $SnGeS_2$ single-layers, have high absorption coefficient, reaching up to 49.7 and 62.5μm^{-1}, high optical conductivity of about 4513 and 3559$\Omega^{-1}cm^{-1}$, as well as low reflectivity never exceed 34.6 and 38.5% in visible region, respectively. Additionally, the maximum photovoltaic efficiency of single-junction solar cells based on $SnGeS_2$ and Sn_2SSe nanosheets can reach as high as 27.47% and 28.12%, respectively. The present outstanding results would motivate both theoretical and experimental researchers to deepen the study of the potential applications of two-dimensional Janus materials based on Tin monochalcogenides in solar cell technology.

Graphical Abstract: