

**PROCEEDINGS
OF THE
107TH INDIAN SCIENCE CONGRESS
BANGALORE, 2020**

**PART II
SECTION OF
PHYSICAL SCIENCES**

President: Prof. Santhosh Chidangil

CONTENTS

I.	Presidential Address	5
II.	Abstract of Platinum Jubilee Lecture	9
III.	Abstracts Symposium / Invited Lectures	15
IV.	Abstracts of Oral Presentations	41
V.	Abstracts of Poster Presentations	51
VI.	List of Past Sectional Presidents	159

107TH INDIAN SCIENCE CONGRESS

JANUARY 3-7, 2020

BANGALORE

I

PRESIDENTIAL ADDRESS

President: Prof. Santhosh Chidangil

PRESIDENTIAL ADDRESS

Advances in Photonics Technologies for Healthcare

Santhosh Chidangil

Centre of Excellence for Biophotonics, Department of Atomic and Molecular Physics,
Manipal Academy of Higher Education, Manipal-576107, Karnataka, India

Email: santhosh.cls@manipal.edu

Abstract

Photonics is the science and technology of light which comprise light generation, manipulation and detection. Photonics technologies have been spread across diverse areas including healthcare, life science, lighting technologies, environmental monitoring, aerospace, telecommunications and many others. Photonic technologies have revolutionized healthcare sector with potential innovations such as optical coherence tomography, laser spectroscopy based devices, photoacoustic imaging, photorefractive keratectomy, optical microscopy, photodynamic therapy, etc. The present work discuss some of the laser based spectroscopic tools which can implemented for medical applications, mainly for disease diagnosis. In vivo screening of oral cancer was performed with laser induced fluorescence technique using laser excitation of the susceptible lesions in the oral cavity. The 325 nm laser radiation can excite several biomolecules present in tissues. This technique relies on evaluating the biochemical changes observed through the spectral variations in normal as well as malignant tissues. The spectral patterns extracted from normal, premalignant, and malignant conditions were able to discriminate with very high sensitivity and specificity. Laser Raman spectroscopy of tissues can easily extended for early diagnosis of diseases with high sensitivity and specificity. High performance Liquid Chromatography (HPLC) combined with Laser Induced Fluorescence developed in our laboratory can record protein profiles of body fluids (saliva, serum etc.) for the diagnosis of various human malignancies. The protein profile instrument assembled in our laboratory has very high detection sensitivity of the order of femtomoles which can detect cancer specific proteins in body fluids.

An optical trap combined with a Raman spectrometer has been developed to study optically-immobilized single, live, red and white blood cells. Raman spectra of RBC recorded using this high sensitivity, dual wavelength apparatus has enabled identification of several vibrational bands; hitherto-unreported lines originate purely from hemoglobin. The richness of the measured spectrum illustrates that Raman studies of live cells in suspension are more informative than conventional micro-Raman studies where the cells are chemically bound to a glass cover slip. Oxidative stress on live and cultured cells due to free radicals and toxic effects by silver nanoparticles are being studied using the Raman Tweezers system by optically trapping individual cell in their physiological medium. An overview of the techniques developed for photonics applications will be presented during the symposium.

107TH INDIAN SCIENCE CONGRESS

JANUARY 3-7, 2020

BANGALORE

II

**ABSTRACT OF
PLATINUM JUBILEE LECTURE**

PLATINUM JUBILEE LECTURE

**Discovering New Topological Phases in Materials under Pressure
using Raman Spectroscopy**

Chandrabhas Narayana

Chemistry and Physics of Materials Unit, School of Advanced Materials (SAMat),
Jawaharlal Nehru Centre for Advanced Scientific Research, Jakkur P.O., Bangalore

560064, India

Email: cbhas@jncasr.ac.in

Abstract

There is a great interest in understanding and finding new Topological Insulators and has become important due to many uses of it in spintronic applications in future. Topological Transitions also are interesting to enhancing the thermoelectric applications of materials. High pressure provides an apt tool to understand the effect of strain in tuning the electronic topological properties of the materials. High pressure simulates the effect of chemical doping in achieving this in real materials. Electronic topological transitions are very well seen by angle resolved photo emission spectroscopy (ARPES). But to perform this the samples need to be freshly cleaved inside a ultrahigh vacuum and the surface is cleaned using Argon sputtering. The electronic band structure should be measured before the sample relaxes. In high pressure since the sample need to be bathed in a hydrostatic medium for applying the pressure, these procedures are near impossible at the present. Hence we need to find alternative methods to identify the topological transitions. Hence in this talk we will demonstrate that use of a combination of Raman spectroscopy, X-ray diffraction and DFT calculations could combined to identify the topological transitions under high pressure conditions. Raman spectroscopy is an inelastic light scattering measurements, which measure the vibrational properties of the molecules and lattice. Here there is a large interaction between electron and phonon (lattice vibration) and it is called the electron phonon coupling. These would affect the lifetime of the phonons and this manifests in the Raman spectroscopy as the

anomalous changes in phonon frequency and phonon linewidth (which is directly influenced by lifetime of the phonon). X-ray diffraction helps us to know if these transformations in the Raman spectra are linked with any structural changes. If there are no structural transitions, these can be easily concluded originating due to electronic origin. In order to confirm that this is due to topological transitions, one can do DFT calculations under pressure. This clearly gives the band overlaps in the electronic band structure and parity. Based on this one can easily find the Topological Transition under pressure. The talk will show using examples how this is achieved. The pressure induced topological quantum phase transitions (TQPT) in TlBiS₂ and 1T-TiTe₂ [1,2] are seen using this approach. We show the evidence of two isostructural electronic transitions in TlBiSe₂, deduced from the unusual electron-phonon coupling (A_{1g} and E_g phonons) at ~0.5 GPa and ~1.8 GPa observed in the Raman scattering measurements. Our first principles density functional theory based electronic band structure, topological invariant Z₂ and mirror Chern number calculations reveal that the phonon anomalies at ~0.5 GPa and ~1.8 GPa are related to the topological insulator and topological crystalline insulator (TCI) transitions, respectively. Both high pressure Raman and powder synchrotron XRD confirm a reversible first order structural phase transition of the rhombohedral phase above 4 GPa. We see that the effect of high pressure on transition metal chalcogenide 1T-TiTe₂, a prominent layered 2D system. Here, we have explored the topologically non-trivial and trivial quantum phase transitions at <math>< 2</math> GPa and <math>< 4</math> GPa with evidence of the minima in c/a ratio concomitant with the phonon linewidth anomalies of E_g and A_{1g} modes. Between ~4 GPa and <math>< 8</math> GPa, a transformation from an anisotropic 2D layer to a quasi-3D crystal network is noticed, which occurs due to increased interlayer Te-Te interactions (bridging) by the charge density overlap. In addition, we observed a reversible first-order structural phase transition from a trigonal ($P3m1$) to monoclinic ($C2/m$) phase above 8 GPa. In order to show that all electronic transitions deduced from Raman and X-ray cannot be deduced to be TQPT, we have taken another example. We have investigated Raman scattering and synchrotron XRD measurements on InTe compound [3]. The pressure induced a semiconductor-to-metal transition in InTe is deduced from the phonon anomalies of A_{1g} and E_g modes along with the decrease and anomaly in Raman intensities at ~3.6 GPa. In distinct pressure regime, the presence of strong anharmonic phonon-phonon

interactions and electron-phonon interactions are noticed from phonons' peculiar behavior. Our Raman scattering experiments up to <19 GPa reveals the pressure induced structural transitions (B37 \rightarrow B1 \rightarrow B2) in InTe.

References

- [1] V. Rajaji, Raagya Arora, Saurav Ch. Sarma, B. Joseph, Umesh V. Waghmare, Sebastian C. Peter, and Chandrabhas Narayana "Phonon signatures of multiple topological quantum phase transitions in compressed TlBiS₂: A combined Experimental and theoretical study" *Phys. Rev. B* 99, 184109 (2019).
- [2] V. Rajaji, Utpal Dutta, P. C. Sreeparvathy, Saurav Ch.Sarma, Y. A. Sorb, B. Joseph, Subodha Sahoo, Sebastian C. Peter, V. Kanchana, and Chandrabhas Narayana, "Structural, vibrational, and electrical properties of 1T-TiTe₂ under hydrostatic pressure: Experiments and theory" *Phys. Rev. B* 97,085107 (2018).
- [3] V. Rajaji, Koushik Pal, Saurav Ch.Sarma, B. Joseph, Sebastian C. Peter, Umesh V. Waghmare, and Chandrabhas Narayana, "Pressure induced band inversion, electronic and structural phase transitions in InTe: A combined Experimental and theoretical study" *Phys. Rev. B* 97, 155158 (2018).

107TH INDIAN SCIENCE CONGRESS

JANUARY 3-7, 2020

BANGALORE

III

**ABSTRACTS OF
SYMPOSIUM / INVITED LECTURES**

Fast Volumetric Bioimaging Based on Temporal Focusing Widefield Multiphoton Microscopy

Shean-Jen Chen

College of Photonics, National Chiao Tung University, 711 Tainan, Taiwan.

Email: sheanjen@nctu.edu.tw

Abstract

In this talk, first I will show that a developed temporal focusing-based multiphoton excitation microscope (TFMPEM) has a digital micromirror device (DMD) which is adopted not only as a blazed grating for light spatial dispersion but also for patterned illumination simultaneously. The TFMPEM has been extended to implement spatially modulated and digital holographic illumination to increase the beam coverage at the back-focal aperture of the objective lens. The axial excitation confinement (AEC) of TFMPEM can be condensed from 3.0 μm to 1.5 μm . By using the TFMPEM with HiLo technique, reconstructed deep-biotissue images according to the condensed AEC structured illumination are shown obviously superior in contrast and better scattering suppression. Then, I will show that temporal focusing-based multiphoton illumination (TFMPI) has the advantage of widefield multiphoton excitation with controlling AEC. We implement the TFMPI to light field microscopy (LFM), illuminating only the volume of interest, thus significantly reducing the background noise and providing higher contrast and accuracy for the light field image reconstruction; furthermore, offering higher penetration depth in scattering tissue via multiphoton. 3D human-skin in situ immunofluorescence images, which are stained with anti-human IgG isothiocyanate fluorescein on the intercellular depositions in the epidermis, are used to demonstrate volumetric bioimaging capability. The volume rate of the TFMPI-LFM can achieve around 100 volumes per second, and observe 3D Brownian motion behaviors of two-micron fluorescent beads. Finally, I will show some preliminary results for improving the TFMPEM images with convolutional neural network.

Hybrid-modality diagnostic imaging and specialty fiber probes for optogenetics applications – role of contrast agents

Murukeshan Vadakke Matham

COLE, NTU, 50 Nanyang Avenue Singapore - 639798

Email: mmurukeshan@ntu.edu.sg

Abstract

High resolution diagnostic biomedical optics is an interdisciplinary branch of science and technology, which uses optics for improving the basic understanding of biological processes to enhance the diagnostic efficiency thereby enabling efficient treatment of human diseases. In most of the cases, conventional types of medical imaging may not be able to detect subtle changes occurring in tissues easily. Each imaging modality has its own advantages and limitations and one cannot fit one single modality for all diagnostic applications. Therefore, the need for a multi or hybrid modality imaging arises. High-resolution imaging with optimal working distance, imaging around opaque obstacles are also of prime important in today's imaging world. However, the quest for multi-modality settings for the diagnostic imaging has posed subduing effects of certain advantages of the respective individual modalities. From these perspectives, a paradigm shift in medical diagnostics was introduced in the recent past by way of enhancing different parameters of interest using nanoscale contrast agents. A detailed analysis on the proposed schemes that can be explored based on the recent works carried out by the author's group for early diagnosis of cancerous growth in colon, and ocular imaging targeting iridocorneal angle and imaging of cornea will be reviewed from this perspective. A high resolution probe with selective spatiotemporal imaging that can find potential applications in opto-genetics will also be discussed.

Fluorescence Lifetime Imaging Microscopy in the Biomedical Sciences

Ammasi Periasamy

WM Keck Center for Cellular Imaging, University of Virginia, Departments of Biology and Biomedical Engineering, Charlottesville, VA 22904, USA

Email: ap3t@virginia.edu

Abstract

In the dynamic cellular environment, proteins and other cellular components undergo many processes – all primarily designed to maintain cellular homeostasis. The desire, however, to capture micro- or nanosecond cellular changes and interactions in living cells in their natural environment, led to the development of increasingly sophisticated imaging technologies. There is a need for high spatial and temporal resolution. Fluorescence lifetime microscopy (FLIM) avoids some of these difficulties, but is technically challenging (Sun et al., Nature Protocols, 2011; Periasamy and Clegg, 2010). Fluorescence lifetime refers to the average time a molecule stays in its excited state before emitting a photon and is an intrinsic property of a fluorophore. Fluorescence lifetime measurements started in early 1870 in the context of phosphorescence (or delayed fluorescence; Phipson, 1870). The first nanosecond lifetime imaging using optical microscopy was first implemented in 1959 using a frequency-domain method (Venetta, Rev Sci. Instrum., 1959)). Since then, numerous methodologies in both frequency domain and time domain evolved for numerous biological and clinical applications.

One of the major FLIM applications is to measure FRET between fluorescent molecules, although the acceptor molecules need not be fluorescent (Periasamy and Day, 2005; Sun et al., Cytometry A 2013). In FLIM-FRET microscopy, FRET events can be identified by measuring the reduction in the donor (D) lifetime that results from quenching in the presence of an acceptor. The energy transfer efficiency (E) can be estimated from the D lifetimes determined in the absence and the presence of the acceptor (A).

Another interesting application is the measurements and quantification of the interrelationship between glycolysis and OXPHOS are of particular interest to researcher. Another auto-fluorescent molecule, Tryptophan (Trp), an essential amino acid - investigated by us using FLIM - is linked to cancer investigations [Alam et al., Sci Rep., 2017; Wallrabe et al., Sci. Rep. 2018; Jyothikumar et al., J Biomed. Opt. 2013] and has been shown to be a putative FRET (Förster resonance energy transfer) donor to NADH by Trp residues contained in enzymes interacting with NADH.

In this presentation, we will discuss the implementation of non-invasive FLIM microscopy techniques in various biological and biomedical applications.

Self-Assembled Micro bottle Resonator for Sensing Technology

Prem B. Bisht*¹, Shubhayan Bhattacharya¹, Aneesh V. Veluthandath¹ and Ganapathy Senthil Murugan²

¹Department of Physics, Indian Institute of Technology Madras, Chennai 600036, India

²Optoelectronics Research Centre, University of Southampton, Southampton SO17 1BJ, United Kingdom

Email: bisht@iitm.ac.in

Abstract

Experimentally measured whispering gallery mode (WGM) of microspheres have quality-factors (Q) ranging from 10-10,000. Q values have been used for high-sensitivity refractometric sensing. The sensitivity can be further enhanced by using self-assembled microbottle resonances (MBRs). In this paper, we report the observation of Fano resonances in self-assembled MBRs. Modes of MBRs extend along the z-axis of the resonator, known as higher order axial modes or bottle modes. Self-assembly of MBRs have been done by using the poly methyl methacrylate (PMMA), a high quality optical polymer, on a tapered optical fibre.

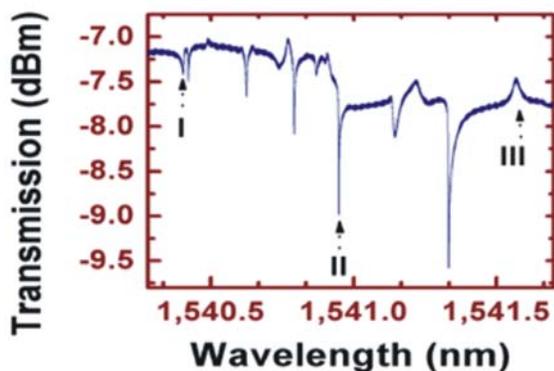


Fig 1. Image of the self-assembled MBR (left). The right panel shows the transmission spectrum of the MBR. Some of the Fano resonances are indicated as I, II, and III.

Figure 1 shows the WGMs of a MBR with the help of a tapered fibre coupling-setup. The spectrum appears as a series of dips which corresponds to WGM resonance. The peaks indicated as I, II and III have asymmetric profiles-a characteristic of Fano resonances. The Fano resonances are formed due to the interference of a high Q of WGMs of MBR and the low Q WGMs of the tapered fiber. These WGMS are being used for temperature sensing in the present laboratory. The details of which will be presented.

Keywords: Microcavity, Whispering gallery modes, Fano resonances, Sensing, Super-resolution

“Chemically synthesized electrodes like CuO and Polypyrrole-Polyaniline Composite thin film as a promising electrode materials for glucose sensor”

V. J. Fulari

Department of Physics, Shivaji University, Kolhapur

Email: vijayfulari@gmail.com

Abstract

Now a days diabetes mellitus has been stand out amongst the most serious reason of death and inability. It is a metabolic issue that starts because of insulin insufficiency. The metabolic issue can be reflected from whether the blood glucose concentration was higher or lower than the typical range. Till today, the numerous electrodes have been investigated for electrochemical biosensor including conducting polymers like Polypyrrole, Polyaniline, carbon based materials and transition metal oxides such as CuO, NiO, MgO, Fe₃O₄, etc.

The well optimized electrode material provides good electrical conductivity, high surface area and electrochemical stability to electrochemical biosensors. To attain the above mentioned-features for tuning the electrochemical performance of biosensor, more efforts has been made to improve the specific surface area, electrical conductivity and stability biosensor electrodes. The present study covers the synthesis of CuO and Polypyrrole Polyaniline thin films by simple, convenient, binder-free, additiveless and cost effective successive ionic layer adsorption and reaction (SILAR), chemical bath deposition (CBD) and electrodeposition method. The preparative parameters like precursor concentration, solution pH, deposition temperature, deposition cycles and deposition time were optimized in order to get good quality thin films.

The characterization of prepared materials is one of the essential things to develop an excellent electrode material for various applications. We have characterized prepared thin films with various characterization techniques. The characterizations include the phase identification,

structural studies, elemental, surface and nanostructural analysis which define the various properties of material. The X-ray diffraction (XRD) technique will be applied for the confirmation of material formation and identification of phase of material. The morphology of surface of the prepared CuO thin films will be studied by means of field emission scanning electron microscopy (FE-SEM). The energy-dispersive X-ray spectroscopy (EDS) technique will be employed for the detection of elemental composition. The electrochemical properties CuO thin films will be studied using cyclic voltammetry (CV). The electrochemical biosensing properties of CuO will be studied using electrochemical workstation having electrochemical cell made up of three-electrodes such as prepared CuO thin film - working electrodes, platinum-counter electrode and Ag/AgCl - reference electrode.

In first part of our work we have prepared CuO thin films with SILAR method. The prepared films were polycrystalline in nature with monoclinic crystal structure. FT-IR study confirms the formation of CuO. The films show rice like morphology. The three-electrode system consisting of platinum as a counter electrode, CuO thin films as a working electrode, Ag/AgCl as a reference electrode and 0.1 M NaOH as an electrolyte is used to evaluate the electrochemical features. The CuO thin film deposited at 150 deposition cycles exhibit the sensitivity $1017 \mu\text{A}\cdot\text{mM}^{-1}\cdot\text{cm}^{-2}$ ($R^2=0.9909$) with linear range 0 to 3 mM toward glucose. In second part of our work we have prepared CuO thin films by CBD method which shows porous, bundles of nanosheets like morphology. These films demonstrates the sensitivity $1594 \mu\text{A}\cdot\text{mM}^{-1}\cdot\text{cm}^{-2}$ ($R^2=0.9918$) with linear range 0 to 3 mM toward glucose. In third part, surface of CuO thin films were modified by various surfactants like CTAB, TRX, and PEG by CBD method. Under optimized conditions, the prepared CuO-TRX electrode showed sensitivity of $2025 \mu\text{A}\cdot\text{mM}^{-1}\cdot\text{cm}^{-2}$. Also, the electrode showed excellent anti-interference properties against physiological interference of ascorbic acid.

In fourth part we have prepared Polypyrrole thin films by potentiostatic electrodeposition method. The prepared thin films show sensitivity of $84.7 \mu\text{A}\cdot\text{mM}^{-1}\cdot\text{cm}^{-2}$ towards glucose. The surface morphology shows formation of microspheres. In fifth part we have prepared Polyaniline thin films by potentiostatic electrodeposition method. The prepared thin films

show sensitivity of $257.37 \mu\text{A} \cdot \text{mM}^{-1} \text{cm}^{-2}$ towards glucose. The surface morphology shows formation of dendrites. In sixth part we have prepared Polypyrrole- Polyaniline thin films by potentiostatic electrodeposition method. The prepared thin films show sensitivity of $4800 \mu\text{A} \cdot \text{mM}^{-1} \text{cm}^{-2}$ towards glucose.

Thus from our work we can conclude that the electrodes prepared by simple chemical methods show better sensitivity towards the glucose. Thus these materials can be used as a promising material for the glucose sensor.

Optical Limiters: materials for protecting human eyes and optical sensors from hazardous laser radiation

Reji Philip

Ultrafast and Nonlinear Optics Lab, Light and Matter Physics Group, Raman Research
Institute, Bangalore 560080
Email: reji@rri.res.in

Abstract

With the advent of powerful laser systems, laser-induced damage of optical components and living matter also has become a matter of serious concern. Optical power limiters are devices which keep the light energy transmitted by an optical system below some specified maximum value, regardless of the energy given at its input. The purpose of optical limiters is the protection of sensitive light detectors and human tissue (particularly the eyes) from accidental exposure to high intensity radiation. Optical limiters should be sufficiently transparent at low input light levels and sufficiently opaque at high input light levels.

The first report of optical limiting appeared in 1967, which made use of the thermal lensing effect. The medium was nitrobenzene, which was irradiated by a cw laser beam of 488 nm wavelength, obtained from an Ar⁺ laser [1]. Thereafter, different optical phenomena have been utilized to achieve optical limiting, which include reverse saturable absorption, two-photon absorption, free carrier absorption, nonlinear refraction, photorefractive and induced scattering. The materials used include organics, organo-metallics, fullerenes, semiconductors, nanocomposites and plasmonic materials [2,3].

In this talk we will discuss the relative advantages and disadvantages of employing the above phenomena for optical power limiting action. Merits and demerits of different types of materials used for limiting will be considered. The basic experimental setup for characterizing optical limiters will be presented. Optical limiting efficiencies measured for different types of novel materials for ultrashort (femtosecond) and short (nanosecond) laser pulses will be discussed

References

- [1] R.C.C. Leite, S.P.S. Porto and T.C. Damen, *Appl. Phys. Lett.* 10 (1967), 100.
- [2] L.W. Tutt and T.F. Boggess, *Prog. Quant. Electron.* 17 (1993), 299.
- [3] D. Dini, M.J.F. Calvete and M. Hanack, *Chem. Rev.* 116 (2016), 13043.

Intense femtosecond laser pulse induced damage to biomolecules

A. K. Dharmadhikari

Department of Nuclear and Atomic Physics, Tata Institute of Fundamental Research, 1,
Homi Bhabha Road, Colaba, Mumbai 400005, India.

Email: aditya@tifr.res.in

Abstract

Damage to biomolecules such as deoxyribose nucleic acid (DNA) induced by ionizing radiation and ultraviolet radiation is well known. With intense femtosecond laser pulses, the localized intensity of $\sim 1 \text{ TW cm}^{-2}$ can be reached during the propagation of these pulses inside a transparent medium such as water, causing ionization and dissociation of a water molecule, subsequently generating low-energy electrons and OH-radical [1].

In this talk, I will discuss damage to aqueous DNA, induced by low energy electrons and OH-radical produced in the water when irradiated by intense femtosecond laser pulses [1-2]. The low energy electrons and OH-radical interact with DNA to induce single-strand breaks (SSBs) and double-strand breaks (DSBs). I will also show that SSB and DSB can be optically controlled [3]. Surprisingly, a protein molecule (myoglobin) in aqueous medium is found to remain intact when irradiated by intense femtosecond pulses [4].

I will also discuss how laser-induced damage to DNA plasmid is minimized by adding specific salts to aqueous medium [5]. Finally, the formation of long-lived hydroxyl radicals by intense femtosecond pulses in water will be discussed. Our findings might be of utility in femtosecond laser-based cancer therapy.

References

- [1] J. S. D'Souza, J. A. Dharmadhikari, A. K. Dharmadhikari, B. J. Rao, and D. Mathur, *Phy.Rev.Lett.*106, 118101 (2011)
- [2] K. Dharmadhikari, H. Bharambe, J. A. Dharmadhikari, J. S. D'Souza, and D. Mathur, *Phys. Rev. Lett.* 112, 138105(2014).
- [3] J. A. Dharmadhikari, A. K. Dharmadhikari, K. C. Kasuba, H. Bharambe, J. S. D'Souza, K. D. Rathod, and D. Mathur, *Sci. Reports* 6,27515 (2016).
- [4] J. J. Chelliah, S. V. K. Kumar, A. K. Dharmadhikari, J. A. Dharmadhikari, D. Mathur, *Appl. Phys. B* 122, 253(2016).
- [5] M. P. Sequeira, J. S. D'Souza, A. K. Dharmadhikari, J. A. Dharmadhikari, P. Vasa, and D. Mathur, *Appl. Phys. Lett.* 113, 113701 (2018).

Photonics Technology for quality evaluation of agricultural products

V P N Nampoori* and Manu Vaishakh

International School of Photonics, Cochin University of Science and Technology,
Cochin 682022

*Email: nampoori@gmail.com

Abstract

There does not exist any fields of human activity where photonics do not have a role to play. In fact the existence of earth's biosphere itself is due to the light from the sun. Photonics, as the technology based on light, has important role to play in various levels of rural development through its applications in the field of agriculture. The present paper reviews the part being played by photonics in improving the techniques for quality evaluation of agricultural products. Attempt is made to describe techniques like speckle interferometry, optical fibre based sensors and laser spectroscopy in respect of their applications in agriculture and related fields.

Physics and technology with quantum materials

P.S. Anil Kumar

Department of Physics, Indian Institute of Science, Bangalore 560012.

Email: anil@iisc.ac.in

Abstract

Quantum materials are materials that exhibit exotic electronic properties that are manifested due to reduced dimensionality, quantum confinement, topology of wave functions etc. Materials such as graphene, topological insulators, Weyl semimetals, spin-liquids etc. belong to this category and is widely investigated by condensed matter physicist and materials scientists in the past couple of decades. They are envisaged to be the potential building blocks for future technological applications. Topological insulators are materials characterized by an insulating bulk and gapless metallic states on the sample surface. Electrical transport in three dimensional topological insulators occurs through spin-momentum locked topological surface states that enclose an insulating bulk. In the presence of a magnetic field, surface states get quantized into Landau levels giving rise to chiral edge states that are naturally spin-polarized due to spin momentum locking. Robust access to topological surface states has presented itself as a formidable challenge due to inevitable bulk doping that mires the effects arising from the topological surface states. In this lecture, I will demonstrate that surface states that are highly amenable to detection and control using electrostatic gating if one uses bulk-insulating topological insulators. Here, we have also fabricated electrostatically defined n-p-n junctions of bulk insulating topological insulator $\text{BiSbTe}_{1.25}\text{Se}_{1.75}$. I will also demonstrate how these fabrication technologies can be extended to get diverse devices such as edge-contacted topological insulator FETs and topological insulator/superconductor hetero-interfaces opening up the possibility for further understanding this new material class.

Classical and quantum implementation of structured optical beams

G. K. Samanta

Photonic Sciences Lab., Physical Research Laboratory, Navarangpura, Ahmedabad
380009, Gujarat, India.
Email: gsamanta@prl.res.in

Abstract

Optical beams of different spatial structures have attracted a great deal of interest due to their variety of applications in science and technology. For example, optical vortices, having phase singularities (phase dislocations) in the wavefront, carry vanishing intensity at the singular point. Due to the screw-like (helical) phase structure around the point of singularity, such beams carries orbital angular momentum (OAM). The OAM associated with optical vortices are important for high resolution microscopy, quantum information, material processing and particle micro-manipulation and lithography. Similarly, Airy beam, a non-diffraction waveform, has peculiar properties of self-healing and self-acceleration. Due to such unique properties, the Airy beam finds many applications including curved plasma wave-guiding, micro-particle manipulation, optically mediated particle clearing, long distance communication, and nonlinear frequency conversion. Typically, such optical beams are generated through the spatial modulation of Gaussian beams. In this talk, we will discuss some of our results on generation of various structured laser beams including optical vortices [1], perfect vortices [2], Airy beam [3], and hollow Gaussian beam [3] and some of their applications in quantum optics experiments [1-5].

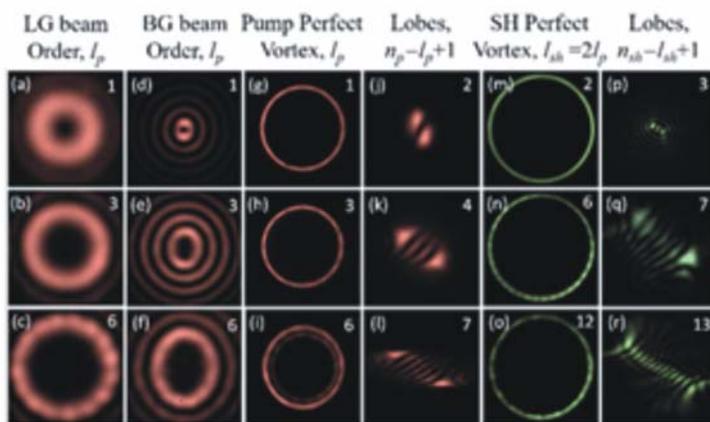


Fig 1. Spatial intensity distribution of the structured beams (a-c) pump vortex beams, $l_p=1, 3$ and 6 , (d-f) Bessel-Gauss beam, (g-i) perfect vortices (PV), (j-l) characteristic lobe structure of PV, (m-o) far field intensity distribution of the SH PV, (p-r) corresponding lobe structures. See Ref. [1,2].

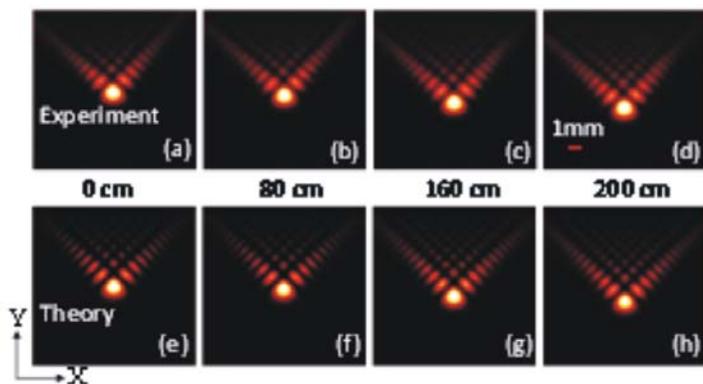


Fig 2. Experimental (1st row) and theoretical (2nd row) intensity distribution of Airy beam along propagation z , (a,e) 0 cm, (b,f) 80 cm, (c,g) 160 cm and (d,f) 200 cm. These images show self-acceleration (bending away from the rectilinear path) of the Airy beam. See Ref. [3].

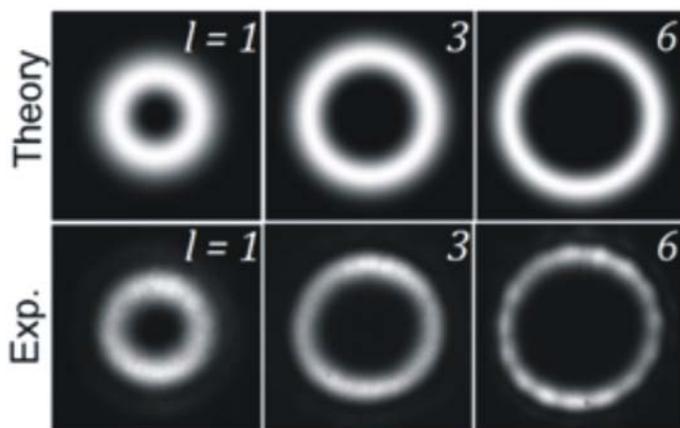


Fig 3. Theoretical (top row) and experimental (bottom row) intensity distribution of hollow Gaussian beam of orders $l=1$ (1st column), $l=2$ (2nd column), and $l=3$ (3rd column). See Ref. [4].

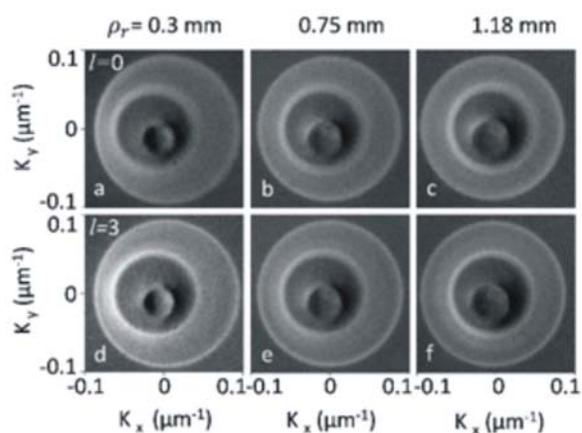


Fig 4. Angular spectrum of down-converted photons while pumped with perfect vortices (PV) of different orders and ring sizes. PV order $l=0$ (1st row,) and $l=3$ (2nd row). See Ref. [5].

References

- [1] N. Apurv Chaitanya, A. Aadhi, M. V. Jabir, and G. K. Samanta, *Optics Letters*, 40, 2614-2617 (2015).
- [2] N. Apurv Chaitanya, M. V. Jabir, and G. K. Samanta, *Optics Letters*, 41, 1348-1351 (2016).
- [3] A. Aadhi, N. Apurv Chaitanya, M. V. Jabir, Pravin Vaity, R. P. Singh, and G. K. Samanta, *Scientific Reports*, 6, 25245 (2016).
- [4] N. Apurv Chaitanya, M. V. Jabir, J Banerji, and G. K. Samanta, *Scientific Reports*, 6, 32464 (2016).
- [5] M. V. Jabir, N. Apurv Chaitanya, A. Aadhi, and G. K. Samanta, *Scientific Reports*, 6, 21877 (2016).

Quantum dot based FRET sensors

Sanjeev R. Inamdar

Laser Spectroscopy Programme (DRDO/KU) and UGC-Centre with Potential for Excellence (CPEPA), Department of Physics, Karnatak University, Dharwad 580003, India.

Email: him_lax3@yahoo.com

Abstract

Recognition based biosensors capable of specifically detecting chemicals, toxins and bio-agents in their environments are under active development in many laboratories. Thus, development of sensitive and reusable environmental sensors is a strong scientific priority. This is accomplished by designing sensor components to carry out analyte recognition and binding while simultaneously producing useful signals through an integrated signal transduction system. Such optically addressed biosensors frequently use fluorescence resonance energy transfer (FRET) for signal transduction. A critical aspect of FRET biosensor development involves optimizing energy donor and acceptor dyes to function in concert with desired recognition elements. FRET has been used in carefully designed sensing systems for proteins, peptides, nucleic acids and small molecules. Recent advances in luminescent colloidal semiconductor nanocrystals or quantum dots (QDs) technology have expanded the range of potentially useful fluorophores in FRET based sensing applications. The unique properties of the QDs allow development of FRET based nanoscale assemblies capable of continuously monitoring target biochemical species in diverse environments. Investigation of FRET in QDs-dye systems and to determine FRET parameters such as efficiency, Forster's distance, FRET rate, etc. using steady state and time resolved fluorescence anisotropy decay measurements are in progress at Karnatak University, alongside study of FRET in QDs-bioconjugate systems of interest with a view to develop biosensors. Results of recent experiments in this area will be presented.

Polymer micro lasers for sensing application

M. Kailasnath

International School of Photonics, Cochin University of Science and Technology, Kochi-
22, Kerala

Email: him_lax3@yahoo.com

Abstract

A special class of circular monolithic optical resonator that currently find potential applications in sensing is Whispering Gallery Mode (WGM) resonator, which has high quality factor (Q), small mode volume (V) and very narrow spectral linewidth. Poly methyl methacrylate (PMMA) is considered to be a promising material for fabricating polymer based WGM resonators because of its high optical transparency, flexibility, ease of fabrication and good chemical compatibility with the organic dyes. The PMMA optical fibre preforms can be prepared by controlled polymerization of methyl methacrylate (MMA) using chemical methods. Dye doped PMMA based graded index, step index and hollow core optical fibers obtained by heat drawing the polymer preforms were used for the generation of strongly modulated WGM lasers. The Q factor for the observed WGM laser emission from such fibres are found to be the range 10^3 - 10^4 . WGM lasers are found to be good candidates for sensing various parameters like refractive index, strain and temperature. The lasing modes from dye doped step index as well as hollow polymer optical fibers were tuned by applying tensile strain. A reversible tuning of the lasing modes over the entire gain spectrum could be achieved in the case of hollow fiber with a tuning range of < 5 nm. Laser emission from Rh B doped PMMA hollow optical fiber was tuned thermally over a range of 0.42 nm. WGM lasing peak shifts linearly towards the shorter wavelength region of the gain spectrum with the increase in temperature with a sensitivity of 0.011 nm / $^{\circ}$ C. During the entire tuning process, the Q factor of the fiber remains almost unchanged. A strongly modulated lasing spectrum has been achieved from dye doped microring embedded in a hollow polymer optical fiber with a side mode suppression ratio of up to 11.8 dB. An active refractive index sensor can be achieved using an interferentially modulated whispering gallery mode lasing

occurring in a microring embedded hollow polymer optical fiber. The lasing modes from the microring embedded hollow polymer fiber sensor shows a redshift with the increase in liquid refractive index yielding a refractive index sensitivity of 188 nm/RIU which is higher than that of dye doped hollow polymer based refractive index sensor. Tunable and highly modulated polymer microlasers may enable fast and sensitive detection in physical, chemical, and biological applications.

References

- [1] Linslal, C. L., Mathew, S., Radhakrishnan, P., Nampoore, V. P. N., Girijavallabhan, C. P., & Kailasnath, M. (2013). Laser emission from the whispering gallery modes of a graded index fiber. *Optics letters*, 38(17), 3261-3263.
- [2] Linslal, C. L., Kailasnath, M., Mathew, S., Nideep, T. K., Radhakrishnan, P., Nampoore, V. P. N., & Vallabhan, C. P. G. (2016). Tuning whispering gallery lasing modes from polymer fibers under tensile strain. *Optics letters*, 41(3), 551-554.

Monitoring of Clear Air Turbulence using Airborne UV LIDAR along the Somalian Coast in Africa

Satheesh Kumar M. K.* and Santhosh Chidangil

Department of Atomic and Molecular Physics, Manipal Academy of Higher Education,
Manipal, Karnataka.

*Email: drmkatheesh@gmail.com

Abstract

Clear Air Turbulence (CAT) in the atmosphere is one of the prominent threats to air travel which results injuries to passengers and crew of the air crafts. The primary cause for this is due to the large scale turbulence which is found to be increasing after global warming became a reality. Turbulent episodes in the atmosphere due to rapid change in the weather pattern which can be detected with air born radars from time to time and issue adequate warnings to the cockpits. However, detection of CAT formed in the atmosphere is rather difficult using conventional radar system because of the poor backscattering efficiencies of water droplets for the long wavelength electromagnetic radiation. This defect could be rectified by employing LIDAR in which laser radiation is used to get the back scattered radiation from turbulent areas which is affected with Doppler shift due to the high speed of the movement of air [1]. Since the backscattering efficiency of UV radiation is high, UV Lidar offers a prominent source to probe turbulence in air. Thus the light can scatter off vortex filaments in the air of varying densities have change in refractive indices. This work presents the spectral variations of the backscattered radiations from the eddies of the turbulent air during the time of Somalian Jet formation in the atmosphere prior to the monsoon season. The results further indicate the strong back scattered signals and their temporal variations that indicate the speed of the curling air associated with the turbulence in the atmosphere. Further, the observation revealed the formation of frequent turbulent systems during the formation of Somalian Jet formation and it offers a severe threat to the air traffic over this region.

Key Words: Clear Air Turbulence, LIDAR, Scattering

References

[1] P. Franken, J. Jenney, and D. Rank, (1996), Airborne investigations of clear-air turbulence with laser radars,” IEEE Journal of Quantum Electronics, vol. 2, p. 147, 1966.

107TH INDIAN SCIENCE CONGRESS

JANUARY 3-7, 2020

BANGALORE

IV

**ABSTRACTS OF
ORAL PRESENTATIONS**

Quantum Entanglement - Recent evidences

N. Shanthi* and Aravind Babu

Department of Physics, School of Sciences, Jain Deemed-to-be University, Bengaluru,
Karnataka

*Correspondence e-mail: shanarao92@gmail.com

Abstract

Many of the concepts in Quantum mechanics are counter-intuitive. In very recent times, there have been a lot of research being carried out, both in terms of theoretical foundations and interpretations, and also in setting up experiments to prove or otherwise of the various theories. Most noteworthy of these, pertain to the discussions regarding the probabilistic nature of quantum mechanics. In this paper, we take a critical look at the arguments given regarding Einstein's 'spooky action at a distance', by describing the most recent experiments conducted by a team at University of Glasgow.

Keywords: quantum entanglement, quantum computing, action at a distance.

Molecular Association and Spectroscopic of Poly (vinyl pyrrolidone) (PVP) Polymer with ethanol and 1-butanol at Varying Temperature

Laxmi Kumari, Sachin Gupta and Manisha Gupta*

Department of Physics, University of Lucknow, Lucknow 226007, India

*Correspondence e-mail: guptagm@rediffmail.com

Abstract

Density (ρ), ultrasonic velocity (u) and viscosity (η) of binary mixtures of Poly(vinyl pyrrolidone) (PVP) Polymer with ethanol and 1-butanol have been measured at various concentrations (0.1 to 0.9%) at varying temperatures (283.15 to 303.15 K). The acoustic impedance (Z), relaxation time (δ) and surface tension (σ) have been evaluated using the experimental data at different concentration of PVP and have been used to explain the hydrogen bonding and intermolecular interactions present in the mixtures. FT-IR spectra of pure PVP and their solutions and optical absorption spectra at concentrations (0.7%, 0.8%, 0.9%) have been recorded in the wavenumber range (4000-500 cm^{-1}) and wavelength range (200-400 nm) respectively. ^1H NMR spectroscopic technique of PVP solutions has been used to observe the selective line broadening or chemical shift displacements of ^1H NMR signals. All the results support each other and help in understanding the interactions in the mixtures.

Keywords: Hydrogen Bonding, FT-IR spectra, optical absorption and ^1H NMR spectra.

Chemically Synthesized nanostructures CuS thin film for energy storage application

S. S. Patil, S. S. Mane, D. V. Pawar, V. J. Fulari*

Holography and Materials Research Laboratory, Department of Physics, Shivaji University, Kolhapur- 416004 (M.S.) India

*Correspondence e-mail: vijayfulari@gmail.com

Abstract

In the present investigation, we have successfully synthesized Copper Sulfide (CuS) thin film on steel substrates via facile and low cost chemical bath deposition (CBD) method. The prepared (CuS) thin film was studied their structural, optical, morphological and compositional analysis by using the different characterization techniques such as XRD, FESEM, and FTIR etc. The X-Ray diffraction (XRD) study suggested that the CuS thin film was well polycrystalline in nature. Also the CuS thin film is nanoflower like morphology which is well suitable for supercapacitor application because it has crack free morphology in nature. And to studied well stoichiometry of Cu and S by using the EDS spectra. Finally, we have checked the supercapacitive properties of CuS thin film with different scan rate. So, as per authors knowledge this is promising materials for energy storage application and it will be used for to develop our county in the field of energy storage.

Keywords: CuS, CBD, Supercapacitor.

Third order nonlinear optical studies of 2, 4, 5 – trimethoxy - 4 - nitrochalcone using femtosecond DFWM technique

**Shivaraj R. Maidur*¹, K. N. Krishnakanth², Parutagouda Shankaragouda Patil¹,
S. Venugopal Rao²**

¹Department of Physics, KLE Institute of Technology, Opposite Airport, Gokul, Hubballi
580030, India.

²Advanced Centre of Research in High Energy Materials (ACRHEM), University of
Hyderabad, Hyderabad 500046, India

*Correspondence e-mail: newtonshiva92@gmail.com

Abstract

The third order nonlinear optical (NLO) properties of 2,4,5-trimethoxy-4-nitrochalcone (**245TMNC**) studied using ultrafast degenerate four-wave mixing (DFWM) technique under 70 fs laser pulses at 800 nm. The linear absorption studies suggests the title Chalcone is optical transparent in the Vis-NIR region. The NLO parameters are found to be larger than that of standard CCL₄. The third order NLO refraction and susceptibility are calculated to be $0.952 \times 10^{-15} \text{ cm}^2/\text{W}$ and $4.934 \times 10^{-14} \text{ esu}$, respectively. The molecular hyper polarizability is found to be $2.472 \times 10^{-33} \text{ esu}$. The time resolved studies reveals that the nonlinear response time of **245TMNC** is very shorter (146 fs), which is the prerequisite for NLO applications.

Keywords: Chalcone derivatives, nonlinear optical properties, degenerate four wave mixing, time resolved DFWM.

Solitary wave propagation in a cold magnetized plasma with relativistic electrons

Shatadru Chaudhuri¹, Harijyoti Mandal², Ayesha Bhattacharjee², Dhruba Jyoti Das² and Jyotirmoy Goswami^{*1&2}

¹Department of Physics, Jadavpur University, Jadavpur, Kolkata-700032

²Department of Physics, JIS University, 81, Nilgunj Rd, Kolkata 700109

*Correspondence e-mail: jyotirmoygoswami09@gmail.com

Abstract

The study of ion-acoustic solitary waves in a magnetized plasma has long been considered to be an important research subject and plays an increasingly important role in scientific research. The study of fractional calculus has opened a new window for understanding the features of ion-acoustic solitary waves and can be a potentially valuable approach for investigations of magnetized plasma. Using a standard reductive perturbation theory, a Korteweg-deVries equation is derived in a cold magnetized plasma with relativistic electrons. Either compressive or rarefactive solitons are shown to exist depending on the various plasma parameters and magnetic field. An analytic soliton solution is obtained and discussed. The behaviours of the soliton amplitude, width, and the Mach number are investigated numerically for different plasma parameters.

Keywords: Ion-acoustic solitary waves, magnetized plasma, fractional calculus, standard reductive perturbation theory, Korteweg-deVries equation, compressive or rarefactive solitons.

Size and Distance Dependent Surface Energy Transfer from NHS Ester activated Alexa Fluor 532 dyeto Gold Nanoparticles

Mallikarjun K. Patil and Sanjeev R. Inamdar*

Laser Spectroscopy Programme, Department of Physics, Karnatak University, Dharwad
580003, India.

*Correspondence e-mail: him_lax3@yahoo.com

Abstract

In the present work, we report energy transfer from NHS Ester activated Alexa Fluor 532 (AF532) dye to gold nanoparticles (AuNPs) of different sizes employing steady state and time resolved fluorescence measurements. The quenched photoluminescence and shortening of the lifetime of AF532 upon interaction with gold nanoparticles confirm the occurrence of energy transfer. Interestingly Forster distance (R_0) between donor and acceptor determined herein varies from 225 to 585 Å with increasing size of AuNPs and suggests that the energy transfer from AF532 to AuNPs is essentially obeying surface energy transfer (SET) process following $1/d^4$ distance dependence. The present study is an experimental quest to explore the dye- metal nanoparticles pairs performing as sensitive chemical and biosensors.

Keywords: Alexa Fluor 532, Gold Nanoparticles, Surface Energy transfer (SET).

H₂SiO IRASER_s in a warm region in interstellar medium

Suresh Chandra* and Mohit K. Sharma

Amity Centre for Astronomy and Astrophysics, Amity Institute of Applied Sciences,
Amity University, Noida 201313, India.

*Correspondence e-mail: schandra2@amity.edu

Abstract

Out of the silicon bearing molecules, found in cosmic objects, the H₂SiO is one of them. Considering that kinetic temperature in some molecular regions is found up to 300 K, for each of the ortho and para H₂SiO, we have considered 200 rotational levels having energy up to 540 cm⁻¹. Performing Sobolev LVG calculations, we have found 5 ortho and 4 para transitions having frequencies in THz and radiative life-time of upper level more than 10 times larger than that of the lower level. These transitions, may be called IRASERs (Infra-Red Amplification by Stimulated Emission of Radiation), having emission feature and may play important role in identification of H₂SiO in a warm region in the interstellar medium.

Keywords: H₂SiO, ortho and para H₂SiO, Sobolev LVG calculations, radiative life-time, IRASERs (Infra-Red Amplification by Stimulated Emission of Radiation).

Colorimetric detection of Mercury (II) ions based on Ag reduced PDMS sponge

Aravind M¹, Santhosh Chidangil^{1&2}, Sajan D. George^{*1&3}

¹Department of Atomic and Molecular Physics, Manipal Academy of Higher Education, Manipal-576104, India

²Centre for Biophotonics, Manipal Academy of Higher Education, Manipal-576104, India

³Centre for Applied Nanosciences, Manipal Academy of Higher Education, Manipal-576104, India.

*Correspondence e-mail: sajan.george@manipal.edu

Abstract

Mercury is one of the primary contaminants of global concern, biotic mercury levels in many aquatic ecosystems are increasingly driven by internal biogeochemical processes. In this study, we propose a facile colorimetric method of detecting mercury (II) ions in aqueous solutions. Polydimethylsiloxane (PDMS) sponges were fabricated via a cost-effective sugar cube leaching method (white) followed by in-situ reduction of silver nanoparticles (AgNPs) on to the surface (brown). AgNPs on reacting with Hg-contaminated solution forms Ag-Hg amalgam and is washed away from sponge reducing the brown color. The color change is proportional to the amount of amalgam formed which in turn depends on Hg (II) ion content, giving a linear relation of mercury content and color change. Ag-PDMS sponge was also treated with ions like Pb(II) which showed no apparent change in color implying the selectivity of the sensor. Presence of AgNPs enhances the Raman spectra and the enhancement factor depends on the amount of AgNPs, which can be utilized to quantitatively analyze the Hg content.

Keywords: Colorimetric detection, Heavy metals, Mercury, PDMS sponge.

107TH INDIAN SCIENCE CONGRESS

JANUARY 3-7, 2020

BANGALORE

V

**ABSTRACTS OF
POSTER PRESENTATION**

Ph.001

The Classical Double Slit Interference Experiment: A New Geometrical Approach

Joseph Ivin Thomas*

Department of Physiology, East Point Medical College, Bangalore

*Correspondence e-mail: dr.ivinthomas@yahoo.com

Abstract

The double slit experiment was first conceived of by the English physician-physicist Thomas Young in 1801. It was the first demonstrative proof that light possesses a wave nature. In this paper, the original geometrical analysis of Young's Experiment is reformulated using an analytically derived hyperbola equation and the shape of the screen used to capture the interference fringe pattern is varied. The hyperbola equation is used to calculate the relative fringe positions for each screen shape. It is suggested that this new analysis be introduced into the Wave Optics chapter of the undergraduate Physics curriculum.

Keywords: Interference, Fringe, Hyperbola, Wavefront, Locus.

Ph.002

**Spectroscopic analysis of Highly Fluorescent Laser Dye
ADS680HO in Conjugate with Green Silver Nanoparticles**

Vadiraj.B.Tangod^{*1}, U.S.Raikar²

^{*1}Department of Physics, Shri Jagadguru Thontadarya Government First Grade College,
Mundaragi - 582118, Gadag, Karnataka, India.

²Department of Physics, Karnatak University, Pavate Nagar-580001, Dharwad,
Karnataka, India

*Correspondence e-mail: vadirajtangod@gmail.com

Abstract

Estimation of ground state and excited state dipole moments of a medically and industrially useful fluorescent laser dye molecule ADS680HO and evaluation of excited state dipole moment by Lippert, Bakhashiev, Kawski–Chamma–Viallet, McRae, Suppan, and solvent polarity methods. Kamlet–Abboud–Taft and Katritzky multilinear analysis for characterizing the solute-solvent interaction contribution into spectral features of the dye has also been studied. Correlation analysis of spectroscopic data with multiple polarity parameters was carried out by multiple linear regression analysis. Optical absorption and fluorescence of ADS680HO in various solvents with attachment of green silver nanoparticles (AgNPs) shows quenching of absorption and fluorescence intensities. This is due to size, shape, and coupling between the AgNPs and the dye, and energy transfer between the dye and the AgNPs. Fluorescence quenching of ADS680HO leads to many applications notably for advancement in biomolecular labeling and fluorescence patterning and chemotherapy in cancer treatment.

Keywords: dipole, ADS680HO, quenching, fluorescence, AgNP's.

Ph.003

Mass composition of cosmic rays from azimuthal asymmetry of shower electrons

Rajat Kumar Dey*

Department of Physics, North Bengal University, Siliguri, WB, 734013

*Correspondence e-mail: rkdey2007phy@rediffmail.com

Abstract

The lateral density distribution (LDD) of shower electrons in a cosmic-ray extensive air shower (EAS) experiment is commonly approximated by a particular type of lateral density function (LDF). A standard perception is being used in air shower physics since long, according to which the LDD is assumed to be symmetric about the EAS axis, and the adopted LDF is adequate for the description of the LDD. However, the simulated electron density of a non-vertical EAS is asymmetric. Quantitatively, the asymmetry can be roughly described in terms of a gap length (GL) between the EAS core and the center of the modified density pattern consisting of several equi-density ellipses. The GL arises from attenuation effect is found to increase with the mass of the shower initiating particle. A different radial dependence of the local age parameter (LAP) is seen, if the modified LDF is applied to simulated electron densities.

Keywords: Simulation, cosmic-rays, EAS, attenuation, electrons.

Ph.004

Lateral shower age parameter and its sensitivity to cosmic ray mass composition

Rajat Kumar Dey*

Department of Physics, North Bengal University, Siliguri, WB, 734013

*Correspondence e-mail: rkdey2007phy@rediffmail.com

Abstract

A Monte Carlo (MC) simulation study of cosmic ray (CR) extensive air showers (EAS) has been carried out in the energy regime of the KASCADE experiment. From the characteristics of lateral distributions of electrons and muons of simulated EAS, some important EAS observables are extracted by a novel approach, and their CR mass-sensitivity is demonstrated. The study takes into account the issue of the experimental lateral density profiles of EAS electrons and muons after introducing the notion of the local age and segmented slope parameters, aimed to extract information on CR mass composition from observed data. The estimated lateral shower age and slope from the analysis of the KASCADE data (KCDC) agrees with the idea of a gradual change of CR mass composition from light to heavy around the knee.

Keywords: Cosmic-rays, EAS, lateral age, local age, slope, simulation, composition.

Ph.005

Transfer of energy from kinetic Alfvén wave to multi-ions in plasma sheet boundary layer region

Radha Tamrakar, P. Varma* and M. S. Tiwari

Department of Physics, School of Mathematical and Physical Sciences, Dr. H. S. Gour
Vishwavidyalaya, Sagar (M. P.)- 470003

*Correspondence e-mail: poornimavarma@yahoo.com

Abstract

Kinetic Alfvén waves are investigated in multi-ions (H^+ , He^+ and O^+) plasma. Damping rate expression is derived using Vlasov's equation and loss-cone distribution function. Graphical interpretation of results is performed for parameters relevant to plasma sheet boundary layer region. Figures are exhibited with respect to $kl-\rho_i$ for $J=1$ and $J=2$. It is observed that narrowing loss-cone limits wave existence towards higher perpendicular wavelength. Ion – gyroradius of each ion is significant for damping of wave with varying density of corresponding ions. This study is useful in understanding the effect of multi-ions in transferring energy from distant tail towards earth.

Keywords: Kinetic Alfvén Wave, Plasma Sheet Boundary Layer, Damping Rate, Multi-ions.

Ph.006

Localized Electron States in Quantum Wells

Richa Saini*, Anita Chamola

Department of Physics, Kanya Gurukul Campus, Gurukul Kangri Vishwavidyalaya,
Haridwar-249404

*Correspondence e-mail: richasaini77@ymail.com

Abstract

The thermodynamic Green's function technique has been emerged as an inevitable and most important tool in the study of complicated systems of interacting particles particularly in the anharmonic phonon-electron problem in a crystal containing randomly distributed isotopic impurities. In the study of electron states in quantum wells the energy spectrum for electrons and phonons in the form of expressions for electron and phonon density of states have been obtained for a crystalline solid and then the same is extended to investigate the electron and phonon density of states of quantum wells. The general trend of quantum well density of states is examined details with the variation with temperature, confined and free regions.

Keywords: Green's Function, Energy Spectrum, Density of State.

Ph.007

Investigation of the nature of radio quiet X-Ray source 1E 161348-5055.1 using Spectral and Timing Analysis

Dr Tamal Sarkar*

High Energy & Cosmic Ray Research Centre, North Bengal University,
Siliguri, WB - 734013

*Correspondence e-mail: tsarkar@nbu.ac.in

Abstract

Neutron stars are remnants of supernovae explosion of massive stars $10M_{\odot}$ upto $20-40 M_{\odot}$. at the time of their formation, neutron stars gain recoil kicks due to asymmetries that develops during the core-collapse process. Neutron stars are classified as Radio Loud and Radio Quiet. 1E 161348-5055.1 is a radio quiet neutron star found in the Centre of RCW103 Supernova remnant and is a periodic X-Ray with a period of 6.67 hours. This source was discovered by the HEAO-2 (Einstein Observatory), which is the first fully imaging X-Ray telescope. This source attracted interest due to the two main reasons. Firstly, its periodicity of 6.67 hrs which is too long for star having age 2000 years, it is behaving like a multi-million-year-old star. Secondly, the star becomes 50 times brighter in between October 1999 and January 2000. Astrophysicist put forward many theories to explain this phenomenon. In present work, the author downloaded one archived data from XMM Newton and analyzed it as well as reviewed the works related to this source to understand the nature of the neutron star 1E 161348-5055.1.

Keywords: SNR, RCW103, Einstein Observatory, Radio loud and Radio quite source, XMM Newton Mission.

Ph.008

Derivation of Einstein's Photo-electric Equation: A Movion Theoretical Approach

Dilip Kumar Modak*

Centre for the Interdisciplinary Research and Applications 45/2, New Santoshpur Main
Road, Kolkata-700075

*Correspondence e-mail: d.modak@rediffmail.com

Abstract

Einstein's Photo-electric Equation $h\nu = \frac{1}{2}mv^2 + \phi_0$ — (i) has been derived (symbols having usual significances) by using the new basic concept of "Movion Theory" according to which the total relativistic energy of moving particle $E_T(= m_0c^2) = mc^2 + m_eL$ — (ii), where m_0 , m , m_e , c and L are the rest-mass, moving-mass, movion-mass (mass of equivalent energy), velocity of light and quantum factor of energy respectively, where value of L varies from 0 to c^2 . Equation (ii) can be also represented by $E_T = mc^2 + \frac{1}{2}mv^2 + \frac{1}{2}mv^2 \left(\frac{3v^2}{4c^2} + \dots \right)$ — (iii). Both equation (ii) and equation (iii) are useful to explain the incident photon, binding electrons of substance and ejected electrons in the Photoelectric effect phenomenon.

Keywords: Photoelectric effect, Photon, Electron, Rest-mass, Movion theory.

Ph.009

A novel approach for the quantum conversion of matter-energy of moving particle

Dilip Kumar Modak*

Centre for the Interdisciplinary Research and Applications 45/2, New Santoshpur Main
Road, Kolkata-700075

*Correspondence e-mail: d.modak@rediffmail.com

Abstract

The smallest particle of energy is represented by the photon. In our previous communications, we described matton, another smallest particle of matter, equivalent in energy to that of photon. Matton may undergo transition from lower frequency V_m to higher frequency V of photon due to the increase of velocity v of a moving particle and vice versa. When a particle moves with velocity v , at the center of the particle, parts of photon and matton participate in matter-energy conversion. This conversion occurs reversibly from matton to photon and from photon to matton making a balance between matter and energy with velocity v and controls the behavior of moving particle.

Keywords: Moving particle, Photon, Matton, Frequency, Matter-energy conversion.

Ph.010

**Quantitative Determination of Essential and Trace Element
Content of Some Medicinal Plants by ICP-MS Technique**

Pakki Suresh Patnaik*¹ and Malla Ramanaiah²

¹Department of Physics, Aditya Institute of Technology and Management, Tekkali-
532201, India

²Department of Chemistry, Aditya Institute of Technology and Management, Tekkali-
532201, India

*Correspondence e-mail: sureshpatnaik.pakki@gmail.com

Abstract

Micro - and macroelements contents of five traditionally used medicinal plants (*Withania somnifera*, *Hemidesmus indicus*, *Cyathula prostrata*, *Andropogon zizanioides* and *Momordica charantia*) were quantitatively evaluated by the inductively coupled plasma mass spectrometry (ICP-MS) technique. The analytical investigation allows totally 20 elements (Li, Be, Al, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, As, Se, Rb, Sr, Ag, Cs, Ba and Tl) from these plant extracts. The ICP-MS techniques are well suited for the analytical control of infusions in order to ascertain the nutritional role of medicinal plants and the daily dietary intake.

Keywords: ICP-MS, Microelements, Macro elements, Medicinal plants.

Ph.011

An Analysis on Secondary Electron Emission from Metals

Ram Pratap Singh*

Department of Physics, SMS Govt. Model Science College, Jiwaji University Gwalior,
(M.P.) India-474009

*Correspondence e-mail: rps22222@gmail.com

Abstract

We have studied the secondary electron emission from metals and semiconductors using high energetic heavy ions and we have observed the thickness dependence of the target, incident angle dependence, projectile energy dependence, ion fluence dependence of secondary electron yields for bismuth, cobalt, aluminum and carbon targets. We have also checked the hypothesis that whether some changes in secondary electron yields (Y) occurs at the time of track formation and we have found that yields increase with thickness and it is empirically related as, $Y(\theta) = Y(0)(\cos\theta)^{-f}$ where f is fitting parameter, Y(θ) is the yield at angle (θ) and Y(0) is the yield at normal incidence. The ion electrode yield is function of energy transferred to the target atoms.

Keywords: projectile energy, ion fluence, bismuth.

Ph.012

A Brief Introduction to Plasma: “The Fourth State of Matter”

Nitin Kumar*

U.G.M School, Nawada Ben Udawant Nagar Bihar

*Correspondence e-mail: nitin_arrah@rediffmail.com

Abstract

The characteristics of plasmas are significantly different from those of ordinary neutral gases so that plasmas are considered a distinct “fourth state of matter”. For example, because plasmas are made up of electrically charged particles, they are strongly influenced by electric and magnetic fields while neutral gases are not. An example of such influence is the trapping of energetic charged particles along geomagnetic field lines to form the Van Allen radiation belts.

In addition to externally imposed fields, such as the Earth’s magnetic field or the interplanetary magnetic field, the plasma is acted upon by electric and magnetic fields created within the plasma itself through localized charge concentrations and electric currents that result from the differential motion of the ions and electrons. The forces exerted by these fields on the charged particles that make up the plasma act over long distances and impart to the particles’ behavior a coherent, collective quality that neutral gases do not display.

Keywords: Moldable substance, magnetosphere, Environment, Plasma televisions, solar corona.

Ph.013

UV – Visible Spectral Analysis of Heart Samples of Sildenafil Citrate and Alcohol Fed Albino Mice

R. Udayakumar*¹, K.V.P Suriyakumari² and Sanjay Kumar²

¹Department of Physics, Annamalai University, Annamalainagar – 608 002. Tamilnadu.

²Department of Anatomy, Sri Manakula Vinayagar Medical College & Hospital, Madagadipet,

*Correspondence e-mail: drrudayakumar@gmail.com

Abstract

The problem of Erectile dysfunction (ED) is growing at an alarming proportion worldwide. Sildenafil citrate is the first approved oral drug for the treatment of ED which has many side effects. Though drinking alcohol is a usual practice in society, it has also many side effects. The present study was aimed at studying the impact of the combined dosage of Sildenafil citrate and Ethanol on the form and function of Heart of Albino mice. UV-VIS spectrophotometric analysis was carried out on Heart samples of Albino mice. From the present study, it was found that the concentration of TBARS, a measure of Lipid peroxidation, increased in all experimental groups when compared with control group. Hence, it is concluded that the combined administration of Sildenafil citrate and Ethanol to the experimental animals culminates in the enhanced levels of Lipid peroxidation which may be indicative of the adverse effects on the function of Heart.

Keywords: Albino mice, Heart, Sildenafil citrate, Ethanol, UV-VIS, LPO.

Ph.014

Electrical Transport across Protein Films – A Development of Bio-inspired Electronics

Ashwini Nawade*, Kunchanapalli Ramya, Sabyasachi Mukhopadhyay

Department of Physics, SRM University, AP-Amaravati Andhra Pradesh, India – 522503

*Correspondence e-mail: ashwini_nawade@srmmap.edu.in

Abstract

We demonstrate the relation between the protein and its variation in electrical conductance by changing concentration of the protein sample in drop-casted films on FTO substrates. Our studies demonstrate that the electrical conductivity of a protein films varies with its concentration as well as by incorporating metal nanocrystals within it. We have observed a significant conductance variation in case of films prepared with different protein concentrations and more studies are required to reveal the effect of nanocrystals on electrical conductance. Electrical transport characteristics of a biomolecule especially protein is beneficial to understand its structural functional relationship, which can be useful in preparing biocompatible electronic devices such as protein-based Field Effect Transistors (FET), Biosensors, etc.

Keywords: Bio-electronics, BSA-protein, Electrical transport, Doping of thin films.

Ph.015

Photovoltaic devices based on Ternary blends of donor and acceptor materials

Shyam Sunder Sharma*

Department of Physics, Govt. Women Engineering College, Ajmer- 305002, India

*Correspondence e-mail: shyam@gweca.ac.in

Abstract

In this paper, we presented ternary blend organic solar cells using conjugated polymer (P) and small molecule (SM) as two donor materials and (6,6)-phenyl-C₆₁-butyric acid methyl ester (PCBM) as a acceptor material. These ternary blend films were fabricated via adding small molecule (SM) having absorption band in longer wavelength region as donor into the blend P: PCBM. The power conversion efficiency (PCE) of ternary solar cells was improved up to 2.82% due to broad band absorption and improved hole mobility. It was further improved up to 3.43 % after solvent treatment and thermal annealing of the ternary active layer due to increase in crystallinity of the active layer upon annealing.

Keywords: Ternary bulk heterojunction, Conjugated polymer, Small molecule, Power conversion efficiency, PCBM, Annealing.

Ph.016

Study of Scattering of Electrons by Equilibrium Phonons in a Two Sub bands Quasi Two Dimensional Electron Gas in a Quantizing Magnetic Field

Madan Jee, Manish Kumar Bhatt*, Sunil Kumar Mishra, Sanjeev Kumar
University Department of Physics, B.R.A. Bihar University Muzaffarpur, Bihar India.

*Correspondence e-mail: m.k.bhatt05@gmail.com

Abstract

We have studied scattering of electrons by equilibrium phonons in a two subband quasi two dimensional electron gas in a quantizing magnetic field. This has been studied in connection with the integer quantum Hall effect. The electron phonon coupling constant is nearly equal to the magnetic field, the phonon induced longitudinal conductivity at high enough magnetic fields may be comparable with impurity induced longitudinal conductivity. A resonant enhancement of the conductivity was found due to interaction of two Landau levels.

Keywords: scattering, phonon, conductivity, Quantum Hall effect.

Ph.017

Absorption spectra of $\text{PbO-Ga}_2\text{O}_3\text{-P}_2\text{O}_5\text{:MoO}_3$ glasses

B. Lakshmana Rao¹, K. Jyothi Raju² K.V. Lakshmi³ and S.V.G.V.A. Prasad^{4*}

¹Dept. of Physics, V.S.R. Govt. Degree & P.G College, Movva, Krishna Dt. A.P.

²Krishna University, Machilipatnam-521001, A.P

^{3&4}Dept. of Physics, Ideal College of Arts and Sciences (A), Kakinada, E.G. Dt. A.P.

*Correspondence e-mail: dr.svgvapasrad@gmail.com

Abstract

PbO-Ga₂O₃-P₂O₅ glasses containing small concentrations of MoO₃ (ranging from 0 to 0.5mol %) were prepared. Absorption Spectral Studies of these glasses were carried out. The studies indicate that the molybdenum ions occupy octahedral positions in larger concentrations in PGPM5.

Keywords: molybdenum ions, octahedral, PGPM5.

Ph.018

Higher order KdV electrostatic structures in a plasma with negative ions and relativistic positron beam

Manas Mohit Dosibhatla*¹, Ayanava Sarkar¹, Tapabrata Kar¹, Atanu Ghosh², Swarniv Chandra³

¹Dept. of Physics, Maulana Azad College, Kolkata.

²Dept. of Physics, Asutosh College, Kolkata.

³Dept. of Physics, Govt. General Degree College at Kushmandi, Dakshin Dinajpur, WB.

*Correspondence e-mail: dosibhatla.mohit@gmail.com

Abstract

We have studied some nonlinear phenomena in plasma. By applying standard perturbation technique, we derived the linear dispersion relation in a two component positron-ion plasma. The positrons are mobile whereas the negative ions form a neutralizing background. In order to study the modulational instability and the formation of envelop soliton a non-linear Schrodinger equation is derived. The effects of external periodic force are investigated. It has been found the amplitude and frequency of the external force is of prime importance in determining the stability criteria. The results obtained help in the understanding of the space plasma.

Keywords: perturbation technique, positron-ion plasma, Schrodinger equation.

Ph.019

Beam Instability in an Electron Positron Ion Quantum Plasma

Manisha Chowdhuri*¹, Ipsita Ghosh¹, Tiasa Saha², Swarniv Chandra³

¹Jogmayadevi College, University of Calcutta, Kolkata-700073, INDIA.

²Lady Brabourne College, University of Calcutta, Kolkata-700073, INDIA.

³Government General Degree College, Kushmandi, Dakshin Dinajpur 733121, INDIA.

*Correspondence e-mail: manishachowdhury2581997@gmail.com

Abstract

We consider a quantum plasma consisting of electrons, positrons and negative ions. The electrons and positrons are mobile while the ions form a neutralizing background. The two streams of electrons and positrons move in opposite directions and parallel to the magnetic field. The perturbations of these two streams are transverse to the streaming. Also, there is small fluctuations in the magnetic field perpendicular to the plane containing the magnetic field and the velocity perturbation. We considered the particle density to be so high so as to give rise to quantum diffraction as well as quantum statistical effects. The recent interest of scientific committee in positron plasma has motivated us to carry out this work. The results will explain many instabilities observed in large electron-positron clouds associated with neutron stars.

Keywords: quantum plasma, velocity perturbation, quantum diffraction, quantum statistical effects, electron-positron clouds.

Ph.020

The Role of Renewable Energy in Rural Development

K.V. Lakshmi^{*1}, K. Jyothi Raju², B. Lakshmana Rao³ and S.V.G.V.A. Prasad⁴

^{1&4}Dept. of Physics, Ideal College of Arts and Sciences (A), Kakinada, E.G. Dt. A.P.

²Krishna University, Machilipatnam-521001, A.P.

³Dept. Of Physics, V.S.R. Govt. Degree & P.G College, Movva, Krishna Dt. A.P.

*Correspondence e-mail: venkatalakshmi.karri@gmail.com

Abstract

Sustainable rural development is vital to the economic, social and environmental protection of countries. It is necessary for poverty removal since global poverty is immense rural. As women use firewood as a cooking fuel, forests are gradually shrinking. This can cause environmental degradation. Wild animals are also endangered. Increasingly, it requires more energy to adapt to a growing population, better life style and produce more food. Power is currently being supplied using natural resources (Biomass, solid fuels, Kerosene, LPG etc.). But these are coming to an end. Therefore, it is very important to replace these natural sources with zero pollution and sustainable energy sources Renewable energy sources are sources that constantly renew throughout the human lifespan. For control pollution, environmental protection, and produce clean high electricity. Through these, a great value to be gained, coordinating of rural development programs initiatives that contribute to sustainable livelihood through efforts at global, regional, national and local levels, as appropriate can be achieved. A healthy and dynamic agricultural sector is an important foundation of rural development, generating strong linkages to other economic sectors.

Keywords: sustainable energy sources, dynamic agricultural sector.

Ph.021

Temperature Dependent Dielectric Relaxation Study of 2-Propanol with N-Propanol Using Time Domain Reflectometry Technique

Balaji D. Achole*

Department of Physics, Shri Havagiswami Mahavidyalaya, Udgir, Maharashtra-413517.

*Correspondence e-mail: b_achole1234@rediffmail.com

Abstract

The complex permittivity spectra for 2-Propanol (2P) with n-Propanol (nP) were determined over the frequency range of 10 MHz to 20 GHz using the time domain reflectometry (TDR) in the temperature range of 25 °C to 55 °C for 11 different concentrations of the system. The static dielectric constant (ϵ_0) and relaxation time (δ) have been obtained by the least square fit method. The dielectric relaxation spectra in all systems studied fits well with Debye equation. Thermodynamic properties used to access the dipole under the influence of applied field. When two liquids are mixed together, there is change in energy of the system & can be interpreted in terms of its activation energy like molar enthalpy & entropy of activation.

Keywords: Time domain reflectometry, excess permittivity, excess inverse relaxation time, Enthalpy & Entropy.

Ph.022

Attenuation Rate of Radio Wave

Anil Kumar*

Department of Physics, R. J. M. College, Saharsa, B. N. Mandal University,
Madhepura, Bihar.

*Correspondence e-mail: drpnpiyush@gmail.com

Abstract

The radio waves are more complex in confined environments. In order to obtain the propagation character of radio wave in the mine tunnel, the electric-field intensity and magnetic-field intensity of horizontal polarization wave are deduced according to Maxwell equation and the boundary condition of tunnel. The attenuation coefficients of electric field in horizontal and vertical polarization are deduced through the traveling wave condition of confined space. The attenuation characters of different position transmitter in rectangular mine tunnels are simulated in an experiment tunnel. In mine tunnel, with the distance of radio wave propagation become further, the near attenuation of vertical polarization radio will become more slowly than horizontal polarization radio. The attenuation is quicker when the transmission distance is 30-50m from the transmitter, then it will be lowered gradually and gently, this is because the distribution of near field is reduplicated with high level modulus. However, when the distance is further, hardly is it affected the basic modulus due to the serious attenuation of high level modulus. Because of the mine environment is very complex, the radio waves in the mine tunnel are affected by the working frequency, tunnel size, the roughness and electrical conductivity of wall, turning, branch, tilt, throttle of the mine tunnels. The results are benefit to evaluate the channel character of wireless network in mine tunnel.

Keywords: Radio Wave, Environment & Attenuation.

Ph.023

**Vibrational (FT-IR, FT-RAMAN) and DFT Analysis of 1, 2, 4, 5 –
Tetrachloro – 3 - Nitrobenzene**

B S Yadav*

Molecular Spectroscopy and Biophysics Laboratory, DN (PG) College, Meerut-
250002, Uttar Pradesh, India.

*Correspondence e-mail: bijendrasingh@gmail.com

Abstract

In the present work, FT-IR and FT Raman vibrational spectra of 1, 2, 4, 5 – Tetrachloro – 3 - nitrobenzene (1, 2, 4, 5 – TC – 3 - NB) have been recorded in the range 4000 – 400 cm^{-1} and 3500 – 100 cm^{-1} respectively. A detailed vibrational analysis has been carried out and assignments of the observed fundamental bands have been proposed on the basis of peak positions and relative intensities. The optimized molecular geometry, vibrational frequencies, dipole moment, molecular polarizabilities and several thermodynamic parameters in the ground state were calculated using DFT(B3LYP) method with 6-31++G (d, p) and 6 – 311++G (d, p) basis sets. With the help of different scaling factors, the computed vibrational wavenumbers are compared with experimental values.

Keywords: 1, 2, 4, 5 - Tetrachloro – 3 - nitrobenzene, DFT.

Ph.024

Future prospects of the solar radiation in rural development

Alok Upadhyay, Yadav Anurag, A.S Mathur, B.P Singh*

Department of Physics, Institute of Basic Science, Dr. Bhimrao Ambedkar University,
Agra – 282002 (U.P.) India.

*Correspondence e-mail: drbps.ibs@gmail.com

Abstract

In the present scenario, the development of the rural areas is the key to a developed country. Energy, environment, and the economic development of rural areas are closely related. In past, the only source, which produced energy in many different manners were fossil fuels, but due to limited quantity and harmful impact on the environment caused by these types of fuels, a new source of energy was identified which is renewable, non-polluting and easily available. In the present work, we have studied about the various applications of solar radiation which helps the development in rural areas of India.

Keywords: Solar radiations, solar energy, renewable energy, rural development.

Ph.025

Solar Lighting Systems in India: Types, Applications and Performance

Vivek Rajdan*¹, Bandana Kumari²

¹Bhupendra Narayan Mandal University, Madhepura, Bihar 852113.

²Kendriya Vidyalaya No. 1, Hardayal Road, Jalandhar Cantt, Jalandhar, Punjab 144005

*Correspondence e-mail: vivekrajdan761@gmail.com

Abstract

In the past few decades, solar energy has been identified as one of the most effective of all the inexhaustible and renewable energy sources. This paper is the overview of the types of solar Lighting system including lanterns, task lights solar home systems and torches currently available in the Indian market. The solar lighting market has grown rapidly in response to a strong global commitment towards providing quality lighting to all the population that is currently without access to electricity. The solar lighting market is saturated with a wide range of products, differing in specifications and performance.

Keywords: Solar, solar Lighting, Photovoltaics, Solar Lanterns.

Ph.026

Microwave Dielectric Characterization of Atarax-Methanol Binary Mixture Using Time Domain Reflectometry Technique

Dongare A. K.*¹, Sayyad S. B.², Kumbharkanae A. C.³, Khirade P. W.⁴

¹Department of Physics, Vasantdada Patil College, Patoda, India.

²Department of Physics, Milliia Arts, Science & Management Science College, Beed, India.

³Department of Physics, S. R. T. M. University Nanded, India.

⁴Department of Physics, Dr. B. A. M. University, Aurangabad, India.

*Correspondence e-mail: akdbeed@rediffmail.com

Abstract

The dielectric relaxation study for hydroxyzine hydrochloride (Atarax) and Methanol binary mixture has been carried out using the time domain reflectometry (T.D.R.) technique at temperature 283K, 288K, 293K and 298K and at different concentrations, in the frequency range of 10MHz to 50GHz. Further, Fourier transform, least squares fit method and Debay model have been used to obtain dielectric parameter viz. static permittivity, relaxation times, excess permittivity, excess inverse relaxation time. The investigation shows the systematic change in dielectric parameters of the system with change in temperature and concentrations. There is almost linear relationship between the values of $\hat{\alpha}_s$, however $\hat{\omega}$ is nonlinear suggest weak intermolecular interaction. And its excess parameters values are positive and negative respectively. The results obtained are used to interpret the nature and kind of solute-solvent interaction.

Keywords: Dielectric constant, Permittivity, Relaxation time, Atarax, Methanol.

Ph.027

Photoluminescence properties of Ho³⁺ doped different borate glasses

K. Venkata Rao*¹, and Y.C. Ratnakaram²

¹Department of Physics, S.B.V.R. Degree College, Badvel-516227, A.P, INDIA.

²Department of Physics, S.V. University, Tirupati-517502, A.P, INDIA.

*Correspondence e-mail: drvenkataoak@gmail.com

Abstract

Ho³⁺ ion embedded in (50-x)B₂O₃-20 PbO-15MgF₂-10NaCl- x Ho₂O₃ (x = 0.2, 0.4, 0.6, 0.8, 1.0 and 2.0 mol%) borate glasses are prepared and investigated using Differential Thermal Analysis (DTA), X-Ray Diffractometer (XRD), Raman spectra, optical absorption and photoluminescence (PL) as function of different concentrations. Thermal stability of borate glass has been calculated from DTA profiles. The amorphous nature of glass matrix is confirmed by XRD. Based on Raman spectra, the functional groups that are present in the glass matrices have been analyzed. Based on the Judd-Ofelt theory, three spectral intensity parameters $\Omega_{\lambda}^{\lambda}$ ($\lambda = 2, 4, 6$) are calculated from absorption spectra. These parameters are used to determine radiative transition probabilities (A_R), radiative lifetimes (τ_R) and branching ratios (β_R) of Ho³⁺ transitions from the excited state manifolds to corresponding lower lying multiplet manifolds. PL spectra show three intense and one weak band due to ⁵F₄ → ⁵I₈, ⁵F₅ → ⁵I₈ and ⁵F₄ → ⁵I₇ transitions respectively. For these transitions luminescence properties are studied. With the increase in the concentration of Ho³⁺ ions, intensity increases upto 0.8 mol% and then concentration quenching is observed. Lifetimes (τ_{exp}) are calculated for all the glass matrices from decay curve analysis. From the above analysis suggest that 0.8 mol % of Ho³⁺ doped borate glasses can be useful for yellow lighting applications in the visible spectral region.

Keywords: Ho³⁺ ion, Judd-Ofelt, Photoluminescence, lifetime, emission cross-sections.

Ph.028

**Analysis of Microstrip Antenna element for Satellite
Communication**

Gauri Shankar¹ & Manish Kumar*²

¹⁺²Marwari High School, Senapat, Lalbag, Darbhanga, Bihar.

²Department of Physics, R. N. College, Pandaul LNMU, Darbhanga, Bihar.

*Correspondence e-mail: mkumars178@gmail.com

Abstract

In this paper we aimed at providing wireless data over long distances in a variety of ways, from point to point links to full mobile cellular type access. Broadband in data communications refer to Broadband Networks or Broadband internet and may have the same meaning as above, so that data transmission over a fiber optic cable would be referred to as broadband as compared to a telephone modem operating at 600 bits per second.

One of the great challenges of broadband is to provide service to potential customers in areas of low population density, such as to farmers and ranchers. In cities where the population density is high, it is easy for a service provider to recover equipment costs, but each rural customer may require expensive equipment to get connected. Department of communication has enhanced optical fibre networks across the country and also plans to lay new optical cables to unconnected areas with support from universal service obligation funds (USOF). Further, large scale WEB HOSTING SERVICES are to be provided.

Keywords: Antenna element, Broadband Network, Service Obligation funds etc.

Ph.029

Laser, Universe and Arrow of Time

Mitali Konwar*¹, Priyakshu Protim Deori² and G.D. Baruah³

¹Moran College, Moranhat, Charaideo, Assam (India) Pin.785670.

²Indian Institute of Technology, Guwahati, Assam.

³Centre for Laser and Optical Science, New Uchamati, Doomdooma, Tinsukia,
Assam -786151.

*Correspondence e-mail: mitalikonwar@rediffmail.com

Abstract

We have presented a comparison between the universe and the Laser. In many ways the physics of laser and the universe are analogous. The root of the analogy is the fact that both laser and early universe depend completely on the quantum nature. We have also presented a simple analogous example of the growth of a flower at successive stages of development and shown how the arrow of time may be represented in these cases.

Keywords: Laser, Universe, time.

Ph.030

Optical Properties of Nd Doped ZnO Nanorod Thin Films

Nishant Kumar*, Anu Katiyar and Anchal Srivastava

Department of Physics, University of Lucknow, Lucknow-226007, India.

*Correspondence e-mail: nishant1986lu@gmail.com

Abstract

Rare earth doped semiconductors have been recently attracting attention due to their various promising applications in optoelectronic devices, photovoltaics, and flat panel displays etc. Here undoped and 4at.%Nd doped films are deposited by sol-gel spin coating method. Randomly oriented nano rods grow throughout surface and comparatively larger surface to volume ratio occurs for 4at.%Nd doped sample. The films are optically transparent and predominantly c-axis oriented with crystallite size less than 30nm. Optical band-gap is tuned between 3.20 to 3.28eV by increasing the Nd doping. Enhanced NBE as well as defect related emission is obtained in 4at.%Nd doped sample.

Keywords: ZnO, Nd doping, photoluminescence.

Ph.031

LORA Technology basics and applications

R. Harini*

Department of electronics, S.K. University, Anantapur-515003, A.P, INDIA.

*Correspondence e-mail: hariniroddam@gmail.com

Abstract

The Long Range (LoRa) technology was first developed by SemTech Company. LoRa is a wireless technology developed for long-range, low-power, low-bitrate and chirp spread spectrum (CSS) radio modulation technology it also provides the ability to connect to sensors more than 15-30 miles away in rural areas. In this study, we present the LoRa system architecture with the functionality of each component and several typical application scenarios of LoRa network. LoRa is widely used into many applications, such as smart metering, factory monitoring and also it can be used to provide sensor information to communities to provide disaster alerts. LoRa networks allow for very long wireless links that can connect villages and towns. LoRa network is emerging as one of the most promising Low Power Wide Area networks (LPWAN). LPWANs represent a new trend in the evolution of the wireless communication designed to enable broad range of Internet of Things (IoT) applications.

Keywords: Long Range (LoRa), low-power wide-area networks (LPWAN), Internet of Things (IoT), Wireless communication.

Ph.032

Transfer of energy from kinetic Alfvén wave to multi-ions in plasma sheet boundary layer region

Radha Tamrakar, P. Varma* and M. S. Tiwari

Department of Physics, School of Mathematical and Physical Sciences, Dr. H. S. Gour
Vishwavidyalaya, Sagar (M. P.)- 470003 INDIA.

*Correspondence e-mail: poornimavarma@yahoo.com

Abstract

Kinetic Alfvén waves are investigated in multi-ions (H⁺, He⁺ and O⁺) plasma. Damping rate expression is derived using Vlasov's equation and loss-cone distribution function. Graphical interpretation of results is performed for parameters relevant to plasma sheet boundary layer region. Figures are exhibited with respect to $k\perp\rho_i$ for J=1 and J=2. It is observed that narrowing loss-cone limits wave existence towards higher perpendicular wavelength. Ion – gyroradius of each ion is significant for damping of wave with varying density of corresponding ions. This study is useful in understanding the effect of multi-ions in transferring energy from distant tail towards earth.

Keywords: Kinetic Alfvén Wave, Plasma Sheet Boundary Layer, Damping Rate, Multi-ions.

Ph.033

A study on effect of solar wind plasma parameters

Rammohan S Bhadoria*¹, Balveer S. Rathore², and D C Gupta²

¹Govt. Model Autonomous Science College, Gwalior, Madhya Pradesh, India.

²School of studies in Physics, Jiwaji University Gwalior, India.

*Correspondence e-mail: rammohan.jnli@gmail.com

Abstract

Today's challenge for space weather research is to quantitatively predict the dynamics of the magnetosphere from measured solar wind and interplanetary magnetic field (IMF) conditions. Correlative studies between geomagnetic storms (GMSs) and the various interplanetary (IP) field/plasma parameters have been performed to search for the causes of geomagnetic activity and develop models for predicting the occurrence of GMSs, which are important for space weather predictions. We find a possible relation between GMSs and solar wind and IMF parameters in three different situations and also derived the linear relation for all parameters in three situations. On the basis of the present statistical study, we develop an empirical model. With the help of this model, we can predict all categories of GMSs. This model is based on the following fact: the total IMF B_{total} can be used to trigger an alarm for GMSs, when sudden changes in total magnetic field B_{total} occur. This is the first alarm condition for a storm's arrival. It is observed in the present study that the southward B_z component of the IMF is an important factor for describing GMSs. A result of the paper is that the magnitude of B_z is maximum neither during the initial phase (at the instant of the IP shock) nor during the main phase (at the instant of Disturbance storm time (Dst) minimum). It is seen in this study that there is a time delay between the maximum value of southward B_z and the Dst minimum, and this time delay can be used in the prediction of the intensity of a magnetic storm two-three hours before the main phase of a GMS. A linear relation has been derived between the maximum value of the southward component of B_z and the Dst, which is $Dst = (0:06) + (7:65)B_z + t$. Some auxiliary conditions should be fulfilled with this, for

example the speed of the solar wind should, on average, be 350 km s⁻¹ to 750 km s⁻¹, plasma β should be low and, most importantly, plasma temperature should be low for intense storms. If the plasma temperature is less than 0.5×10^6 K then the Dst value will be greater than the predicted value of Dst or if temperature is greater than 0.5×10^6 K then the Dst value will be less (some nT).

Keywords: solar wind — geomagnetic storms (GMSs) — interplanetary magnetic field (IMF).

Ph.034

RFID Based Centralized Patient Monitoring System

Suneetha Uppala*

Department of Electronics, S.K. University, Anantapur, Andhra Pradesh 515003.

*Correspondence e-mail: satwikuppala@gmail.com

Abstract

Radio Frequency Identification (RFID) having many applications within that the patient monitoring system is one. In the present work consisting two main parts, one is patient record maintenance and second is patient monitoring. Sometimes patient maintained many health records and after which remembering the concerned doctor's name and other details. This becomes impossible at a certain point of time when the details have to be conveyed. To make it easier this concept of maintaining a centralized system and sharing the information through the use of RFID technology. RFID is known for its unique ID number. Using this advantage, in the first section the monitoring of a patient is done whenever he arrives at the hospital. In case of any shifts from the hospital the information is still available. Every patient is provided with a unique RFID number and all the details regarding the patient and treatments are stored in a centralized database which is retrieved by the server. The second section patient is regularly monitored by the temperature and heartbeat sensor. The moment the value crosses the normal range a message is sent through GSM/GPS to the nearest hospital with its location and also to a relative. Assistance is provided accordingly to the patient.

Keywords: RFID Reader, RFID Tag, GSM Modem, sensors, micro-controller.

Ph.035

Renewable Energy on Tribal Lands of Andhra Pradesh

Srinivasa Rao Vanukuru*¹, Gangadharudu D.² and Venkateswara Rao B.³

¹Govt. Degree College, Rampachodavaram-533288, AP.

²SRVBSJBMR Degree College, Peddapuram, AP.

³SS&N College, Narasaraopeta, AP.

*Correspondence e-mail: drrao.vanukuru@gmail.com

Abstract

Indian tribes comprise 573 communities that constitute roughly 8 percent of the nation's total population of more than 1 billion. In eastern India the tribals are concentrated in the hilly areas of the Eastern Ghats' forests (Chhattisgarh, Orissa, Jharkhand and Andhra Pradesh). The major occupation of these tribes is primarily agriculture and collection of non-timber forest produce (NTFP). Their rich culture is well depicted in their folk songs, dances, art and craft, and music according to regional differences.

Renewable energy is a natural source of energy that is abundant and or regenerative. There are many different types of renewable energy such as solar, wind, biomass, geothermal, and hydroelectric. Energy and Infrastructure are the most significant issues in developing and sustaining economic growth on tribal lands. Tribal lands contain enormous potential for renewable energy. Since a large number of tribal communities (approximately 8 million people) in India are geographically scattered, consuming very small quantities of electricity, extending the grid may not be a viable solution, as compared with energy generation using local, renewable resources. Most tribal areas rely mainly on traditionally extracted fuel wood for cooking and heating, on kerosene (replacing traditional oil) for lighting, on manual and animal power for agriculture.

The paper can assist tribes in East Godavari District of Andhra Pradesh, who have interest or want an introduction to renewable energy the resources, to begin their quest to understand, develop, and eventually implement renewable energy on tribal lands.

Keywords: Wind and Solar, Electricity, Renewable energy, Wind Power, Tribal Lands.

Ph.036

Study of Dielectric Resonator Antenna for Wireless Communication

Dinesh Kumar*

Department of Physics, B.R.A. Bihar University, Muzaffarpur, Bihar, India.

*Correspondence e-mail: dineshdevanshu1978@gmail.com

Abstract

A comparative study of DRAs (RDRA, CDRA and HDRA) have been made in this paper. In this paper it is established that RDRA (in terms of parameters like impedance bandwidth, degree of freedom, resonant frequency - simulated and calculated) may be the better choice for further improvement in the design of Dielectric Resonator Antenna. The rudimentary geometries of DRA are rectangular, cylindrical and hemispherical, which are used for investigation of DRA performance. These rudimentary geometries of DRA give a better understanding of design parameters of an antenna and their effect on return loss, impedance bandwidth, benefit and resonant frequency. In terms of percentage the bandwidth of RDRA, CDRA and HDRA are calculated as 56%, 50% and 46%. Thus it was found that the rectangular DRA provide better resonance level as compared to another geometries.

Keywords: RDRA, CDRA, HDRA, Impedance bandwidth, resonant frequency, Degree of freedom.

Ph.037

Raman spectroscopic investigation of tissue homogenate for the sensing of cervical cancer

**Ajaya Kumar Barik¹, Jijo Lukose¹, Reena V John¹, Rekha Upadhya²,
Muralidhar V. Pai² and Santhosh Chidangil*¹**

¹Department of Atomic and Molecular Physics, Manipal Academy of Higher Education,
Manipal

²Department of Obstetrics & Gynecology, Kasturba Medical College, Manipal, Manipal
Academy of Higher Education, Manipal

*Correspondence e-mail: santhosh.cls@manipal.edu

Abstract

Cervical cancer is one of the leading cause of cancer mortalities in females globally. Optical techniques are momentum these days for the early detection and diagnosis. Raman spectroscopy is one amongst the most explored method by biophotonics community for cancer diagnosis. This technique is able to provide the molecular fingerprinting of biomolecules without the necessity of any fluorophore agents. In the present work, Raman studies have been performed using biopsy tissues obtained from volunteers.

Keywords: Cervical cancer, Raman spectroscopy, molecular fingerprinting, fluorophore.

Ph.038

UV Absorption Spectroscopic Study of Gases Using Laser Driven Light Source

Nidheesh V R¹, Aswini Kumar Mohapatra², Unnikrishnan V K¹, and Rajeev Kumar Sinha¹ and Santhosh Chidangil*¹

¹Department of Atomic and Molecular Physics, Manipal Academy of Higher Education, Manipal

²Department of Respiratory Medicine, Kasturba Medical College, Manipal

*Correspondence e-mail: santhosh.cls@manipal.edu

Abstract

Absorption spectroscopy remains the most widely used technique for the study of liquids and gases due to accuracy, simplicity, and ease of use. A Laser-driven light source (LDLS EQ-99X) is an ultra-high brightness and high stability broadband source which eliminates the need for multiple lamps like D2, Tungsten and Xenon Arc. Setup for the UV absorption study of gases has been made by using LDLS as a light source and CCD coupled spectrograph as a detector. A sealed gas chamber has been used for the absorption spectroscopic study. This work can be extended further to air quality monitoring and for the clinical breath analysis.

Keywords: Absorption spectroscopy, Laser-driven light source, gas chamber, clinical breath analysis.

Ph.039

Optical Tweezers combined with Micro-Raman spectroscopy for biological applications

Jijo Lukose¹, Mithun N¹, Ganesh Mohan², Shamee Shastry² and Santhosh Chidangil*¹

¹Department of Atomic and Molecular Physics, Manipal Academy of Higher Education, Manipal

²Department of Immunohematology and Blood Transfusion, Kasturba Medical College, Manipal, Manipal Academy of Higher Education, Manipal

*Correspondence e-mail: santhosh.cls@manipal.edu

Abstract

Conventional Raman spectroscopy has constraints in case of single, live cell investigations due to the random motion of cells suspended in an aqueous media. The combination of Raman spectroscopy along with the optical tweezers paves biomedical researchers a better approach for gaining biochemical signatures at individual cell level. Raman Tweezers can be thus very advantageous for probing live individual cells in absence of any exogenous labels and experiments can be also performed in aqueous solutions since water is a weak Raman scatterer. Present work demonstrates the capability of Raman Tweezers as a label-free, sensitive analytical tool for various biological applications.

Keywords: Raman Tweezers, Raman scatterer.

Ph.040

Raman spectroscopy of blood components for the sensing of cardiovascular diseases

Mithun N.¹, Jijo Lukose¹, Reena¹, Tom Devassia² and Santhosh Chidangil*¹

¹Department of Atomic and Molecular Physics, Manipal Academy of Higher Education,
Manipal

²Department of Cardiology, Kasturba Medical College, Manipal, Manipal Academy of
Higher Education, Manipal

*Correspondence e-mail: santhosh.cls@manipal.edu

Abstract

Cardiovascular diseases are found to be the leading cause of mortality as per the global status. As per the statistics, the mortality rate due to cardiovascular diseases in our country raised from 1.3 million in 1990 to 2.8 million by the end of 2016. Moreover, more than half of the deaths resulted from cardiovascular diseases were occurs in subjects less than 70 years old. These statistics demands the necessity of developing novel and sensitive diagnostic tools for the detection of cardiovascular diseases. Raman spectroscopy have been explored in the present work for the sensing of cardiovascular diseases by the investigation of blood components.

Keywords: Cardiovascular diseases, sensitive diagnostic tools.

Ph.041

NIR Luminescent Gold Nanocluster- NIR Plasmonic Copper Sulfide Nanoparticle Hybrid for Cancer Cell Imaging and Therapy

Sanoop Pavithran M.¹, Sajjan D. George^{1&2}, Santhosh Chidangil¹ and M. A. Habeeb Muhammed*¹

¹Department of Atomic and Molecular Physics, Manipal Academy of Higher Education, Manipal, Karnataka, 576104, India

²Centre for Applied Nanosciences, Manipal Academy of Higher Education, Manipal, Karnataka, 576104, India

*Correspondence e-mail: habeeb.muhammed@manipal.edu

Abstract

Gold nanoclusters (NCs) are promising candidates for bio-medical applications as they possess strong and tunable luminescence, long fluorescence lifetime, photo-stability, bio-compatibility, ultra-small size and thermal stability. Interestingly, by combining NCs with other functional nanomaterials, their range of possible applications can be expanded. Hybrid nanomaterials often result in new properties and/or enhanced existing properties. Hybrids can achieve multiple functionalities in a single entity that is not possible by NCs alone. In this regard, a new nanohybrid combining NIR luminescent gold NCs and NIR plasmonic copper sulfide nanoparticles is fabricated via biomineralization process. Copper sulfide is a doped semiconductor nanoparticle with ultra-small core sizes (3-10 nm) exhibiting plasmons even in the NIR-II window. The nanohybrid is easy to fabricate, bio-compatible and multifunctional. They can be used for simultaneous luminescence imaging, plasmonic imaging, photothermal therapy and photodynamic therapy of cancer cells

Keywords: Gold nanoclusters, NIR luminescent gold NCs, biomineralization.

Ph.042

**Laser-Induced Breakdown Spectroscopy (Libs) Combined With
Principal Component Analysis: A Preliminary Study for Plastic
Waste Management**

Adarsh U.K., Unnikrishnan V.K.* , Aseefhali Bankapur and Santhosh Chidangil
Department of Atomic and Molecular Physics, Manipal Academy of Higher Education,
Manipal

*Correspondence e-mail: unnikrishnan.vk@manipal.edu

Abstract

Plastic wastes are becoming a global hazard which causes environmental pollution and their non-degraded traces are precarious to living organisms. The recycling of plastics is challenged by the difficulty in separating their classes from the waste. One of the spectroscopic techniques, LIBS is applied in combination with principal component analysis (PCA) on laboratory made pure plastic samples of different classes including polypropylene (PP), polycarbonate (PC) and Polymethylmethacrylate (PMMA) in the current work. It was able to distinguish between plastics by applying PCA on their LIBS spectra and the results turned out to be promising towards the future work.

Keywords: LIBS, principal component analysis (PCA).

Ph.043

High-performance liquid chromatography combined with laser-induced fluorescence technique (HPLC-LIF) for the detection of cardiovascular diseases

**Reena V. John¹, Ajay Kumar Barik¹, Jijo Lukose¹, Tom Devassia²
and Santhosh Chidangil*¹**

¹Department of Atomic and Molecular Physics, Manipal Academy of Higher Education,
Manipal

²Department of Cardiology, Kasturba Medical College, Manipal, Manipal Academy of
Higher Education, Manipal

*Correspondence e-mail: santhosh.cls@manipal.edu

Abstract

Development of protein profiling methods combined with different spectroscopic tools have been a promising technique for the detection of biomarkers, which ultimately aids in the diagnosis of various health conditions. Being the foremost cause of global mortality, there is always a high interest towards the detection of cardiovascular diseases from body fluids. This study deals with the application of high-performance liquid chromatography in combination with laser-induced fluorescence (HPLC – LIF) for the protein profile analysis serum samples. The principal component analysis showed clear discrimination between samples from healthy volunteers and patients.

Keywords: protein profiling, biomarkers.

Ph.044

Facile Fabrication of Slippery Liquid Infused Porous Surfaces

**Swithin Hanosh¹, Unnikrishnan, V. K.¹, Santhosh Chidangil^{1&2},
Sajan D. George^{*1&3}**

¹Department of Atomic and Molecular Physics, Manipal Academy of Higher Education,
Manipal-576104, India

²Centre for Biophotonics, Manipal Academy of Higher Education, Manipal-576104, India

³Centre for Applied Nanosciences, Manipal Academy of Higher Education,
Manipal-576104, India

*Correspondence e-mail: sajan.george@manipal.edu

Abstract

Nature-inspired biomimicking of surfaces to control the surface wettability is a burgeoning research area due to the widespread applications, ranging from biomedical sciences to paint industry. In this study, Napthene pitcher plant-inspired slippery surface is fabricated on aluminum substrate through hydrothermal synthesis and on various substrates by coating the substrate with a thin Polydimethylsiloxane (PDMS) layer infused with silicone oil. Micro-/nano-structures required for porous structure layer on the aluminum substrate is obtained by depositing zinc structures on the substrate surface through hydrothermal synthesis. These structures are necessary for the lubricant oil to wick within the substrate top layer. The fabricated structure can find potential application in liquid repelling surfaces and corrosion-resistant surfaces due to the thin layer of lubricating oil between the metal surface and the air. Another simple technique demonstrated here to achieve a slippery surface on various substrate involves coating the substrates with a solution consisting of a mixture of PDMS and PDMS cross-linker diluted with hexane. Since the PDMS is chemically identical to silicone oil and exhibits chemical affinity towards the oil, not only will the oil swell the PDMS network, it will resist any test liquid from displacing the lubricating oil and as a result form a stable slippery surface. Moreover, the PDMS coating can be replenished with more silicone oil once the infused oil is depleted.

Keywords: Biomimicking, Polydimethylsiloxane (PDMS), hydrothermal synthesis.

Ph.045

High Performance Liquid Chromatography – Laser Induced Fluorescence (HPLC-LIF) study of Cataract lens fluid

Sphurti Adigal¹, Ajay Kumar Barik¹, Reena V. John¹, Jijo Lukose¹, Sulatha V. Bhadary², Santhosh Chidangil*¹

¹Department of Atomic and Molecular Physics, Manipal Academy of Higher Education, Manipal

²Department of Ophthalmology, Kasturba Medical College, Manipal, Manipal Academy of Higher Education, Manipal

*Correspondence e-mail: santhosh.cls@manipal.edu

Abstract

Cataract is a condition which ultimately results in minimal visuality of human crystalline lens due to its clouding nature. This disease is most commonly observed in diabetic patients than in normal adults. According to the latest reports from World Health Organisation (WHO), about 150 million people are suffering from Diabetes Mellitus. The damage of lens is mainly due to the increased intra-ocular pressure. As per our knowledge, protein profiling of crystalline lens fluid has not been yet analyzed using HPLC-LIF. The focus of our study deals with the investigation of cataract eye lens fluid from diabetic and non-diabetic subjects using protein profiling.

Keywords: Human crystalline lens, Intra-ocular pressure, Cataract eye lens fluid, Protein profiling.

Ph.046

Development of compact multi-modal LIBS-LIF-Raman spectroscopy system for in-situ material characterization

Dhanada V.S., Sajjan D. George, Santhosh Chidangil, Unnikrishnan V.K.*

Department of Atomic and Molecular Physics, Manipal Academy of Higher Education,
Manipal– 576 104, Karnataka, India

*Correspondence e-mail: unnikrishnan.vk@manipal.edu

Abstract

The hyphenation of two or more laser based spectroscopic techniques became more popular due to its wide spread applications in material characterization. In this paper, we demonstrate a system that combines three different spectroscopic techniques which shares almost similar instrumentation features; LIBS (Laser induced breakdown spectroscopy), Raman spectroscopy, and LIF (Laser induced fluorescence). LIBS, Raman, and LIF are the most powerful and promising tool for material characterization. The uniqueness of our setup is the utilization of single laser and a single detector, which makes the system overall compact and cost effective, and can be used for field based applications. We are also emphasizing the optimization of various experimental parameters to achieve LIBS, Raman, and fluorescence signals with high signal to noise ratio.

Keywords: Laser induced breakdown spectroscopy (LIBS), Raman spectroscopy, Laser induced fluorescence (LIF).

Ph.047

Parametric study of different LIBS signal enhancement strategies

**Keerthi K., Sajan D. George, Suresh D. Kulkarni, Santhosh Chidangil and
Unnikrishnan V. K.***

Department of Atomic and Molecular Physics, Manipal Academy of Higher Education,
Manipal– 576 104, Karnataka, India

*Correspondence e-mail: unnikrishnan.vk@manipal.edu

Abstract

Though Laser Induced Breakdown Spectroscopy (LIBS) is a promising analytical method to monitor heavy metals in aqueous solutions on site, its sensitivity for such studies is still a problem. Most of the LIBS investigations were performed on solid and gas samples that provide a uniform surface, greater reproducibility and sensitivity. In this work, we focus on investigating the performance of LIBS technique using certain signal enhancement strategies by different optical modalities. Our results reveal that this system may be useful in designing a robust method for trace elemental detection in liquid samples. The aim of the present work is to design a direct coupled system in which the whole plasma signal can be completely pass through the spectrograph having high throughput with greater accuracy and repeatability. The focus of the present work is to enhance the LIBS intensity using different optical schemes for trace elemental detection using the current developed direct coupled system. The optimization of several parameters (laser energy, different angle of collection) in order to achieve maximum signal collection and relative Std. deviation of two spectrographs are described. LIBS spectra for four samples have been recorded using different angle of collection geometry, also monitored the direct plasma collection to the spectrograph. These results were compared with result obtained from LIBS experiments which used a lens to directly couple the plasma to the Czerny Turner spectrograph.

Keywords: Laser induced breakdown spectroscopy (LIBS), Collection geometry, Plasma, Czerny Turner spectrograph.

Ph.048

Classical-Quantum correspondence by using Rydberg wave packets

Supriya Chatterjee*

Dept. of Physics, Bidhannagar College, EB-2, Sector-1, Salt Lake, Kolkata-700064

*Correspondence e-mail: supriya_2k1@rediffmail.com

Abstract

We explore the classical-quantum correspondence by the dynamics of half-cycle pulse induced Rydberg wave packet. Exact analytical expressions for $\langle x \rangle$, $\langle x^2 \rangle$, $\langle p \rangle$, and $\langle p^2 \rangle$, and hence the uncertainty product ($\Delta x \Delta p$) are obtained for the wavepacket. The time variations of these quantities are shown. From the time variation of the uncertainty product we explained how a quantum mechanical object is transiently localized in phase space and classical behaviour becomes dominant. The quantum mechanical state is reached via the phenomenon 'collapse'. Again it gets back to classical state by 'revival'.

Keywords: Classical-quantum, Rydberg wave packet.

Ph.049

On the shaping of Rydberg wave packets

Supriya Chatterjee*

Dept. of Physics, Bidhannagar College, EB-2, Sector-1, Salt Lake, Kolkata-700064

*Correspondence e-mail: supriya_2k1@rediffmail.com

Abstract

We study the change of shape of a twice-kicked quasi-one dimensional Rydberg wave packet.

The first half-cycle pulse (HCP) creates the wave packet and a time delayed second HCP changes its shape. If q_2 be the momentum transferred by the second HCP and t_1 be the time delay between two pulses then these are the two parameters which help to change the shape of the initial wave packet. It is shown that t_1 is more effective for shaping a wavepacket than q_2 . We also study that the super-revival time obeys a definite law, viz $T = 2mn^2$, where m is an integer and n is the initial quantum number of Rydberg electron which receives the first kick, does not change due to application of the second pulse.

Keywords: Rydberg wave packet, half-cycle pulse, revival, super-revival, change of shape.

Ph.050

Study of Effect of Temperature and Pressure on the Intensity of Scattered EM Wave from Atmosphere

Surendra Roy*

Department of Physics, L.S. College, Muzaffarpur, Bihar - 842001

*Correspondence e-mail: surendra15268@rediffmail.com

Abstract

The time varying properties due to weather conditions particularly in troposphere effects on radio wave propagation and produce random variations in the amplitude phase, frequency, polarization, coherence band width, delay spread and propagation direction of the electromagnetic waves. Changes in climatic conditions are products of meteorological factors like rain, fog, snow etc. Stefan Boltzmann Law studied in the total energy intensity radiated from a black body depends upon the temperature of the black body. Problem came in my mind, that what will be the intensity of EM wave after scattering from meteorological precipitation due to change in temperature and pressure with permeability of the medium as a parameter. We have tried to give a relation between intensity of reflected EM wave with temperature and pressure in this article.

Keywords: Meteorological precipitation, Polarization, Reflectivity permeability.

Ph.051

**Slow light in four-level quantum well nanostructure under
electromagnetically induced transparency windows**

Sajia Yeasmin, Sabanam Talukdar, and Nituborgohain*

Department of Physics, University of Science & Technology, Meghalaya, Baridua, 9th
Mile, Ri-Bhoi, Meghalaya-793101

*Correspondence e-mail: nituborgohain.ism@gmail.com

Abstract

We present an investigation of slow light propagation in a four-level asymmetric multiple quantum well system, wherein a weak probe pulse and two strong control laser beams are interacting in an N-type excitation scheme. Employment of the first control laser beam creates an electromagnetically induced transparency (EIT) window, while the second control beam splits the EIT window into two parts. The group velocity of the probe field in the quantum well system is slowed down by 10^5 times as compared to the speed of light in vacuum. These results may have potential application in optical information engineering in solid systems.

Keywords: Electromagnetically induced transparency; Multiple quantum well; Density matrix formalism; Optical susceptibility; Rabi frequency; Control field detuning; Group velocity.

Ph.052

Simulation of gold nanoparticles on boron nitride nanosheet

J. Meena Devi*

Centre for Nanotechnology & Advanced Biomaterials (CeNTAB) and School of Electrical & Electronics Engineering (SEEE), SASTRA Deemed University, Thanjavur 613401, Tamilnadu India.

*Correspondence e-mail: jmeenadevi@sastra.ac.in

Abstract

The self-assembly of two pristine gold nanoparticles on atomically thin boron nitride nanosheet at room temperature has been studied using molecular dynamics simulation technique. The gold nanoparticles have undergone coalescence and they have been adsorbed on the surface of boron nitride nanosheet due to the van der Waals force. The structural features of this gold-boron nitride nanocomposite have been determined and discussed in detail. The conformation of the gold-boron nitride nanocomposite influences their optical, catalytic and adsorption properties. So this simulation results may aid the understanding, design and development of the gold-boron nitride nanocomposite for sensing and biological applications.

Keywords: Gold nanoparticles, Boron nitride, Coalescence, Nanocomposite, Molecular Dynamics simulations.

Ph.053

**Modified Relativistic Spinning Sphere in Terms of Square Well
Energy Levels**

Sovan Ghosh*

Department of Physics, Vijaya College, R. V. Road, Bangalore – 560004, India.

*Correspondence e-mail: gsovan@gmail.com

Abstract

Relativistic spinning sphere is one of the semi classical models of the electron. It was modified with the introduction of charge following a helical path. But the modified relativistic spinning sphere model was unable to conclude regarding the energy levels within the model. In the present article, the energy level expressions are introduced in terms of classical electron radius comparing the model with infinite square well.

Keywords: Electron, Relativistic spinning sphere, Zitterbewegung, Energy levels.

Ph.054

Synthesis of SnO₂ thin films via sol-gel spin coating method and its characterization

Vishwas Pratap Banga, Ankit Gupta, Mahendra Kumar*

Department of Physics, University of Lucknow, Lucknow (U.P.) - 226007.

*Correspondence e-mail: mklulko@gmail.com

Abstract

In this paper, Tin Oxide (SnO₂) thin films were prepared by the use of simple sol-gel spin coating method with the use of non-alkoxide SnCl₄·2H₂O as a precursor. Structural, Optical properties and surface morphologies of the SnO₂ thin films were characterized by X-ray diffraction (XRD), Scanning electron microscopy (SEM), FTIR & UV-visible techniques. The results which found in experiment show that the samples have a tetragonal rutile structure.

Keywords: Sol-gel, SnO₂, Thin Film, XRD, SEM, FT-IR, UV-Visible.

Ph.055

Diverse Variety of Liquid Crystalline Phases

Purna Chandra Barman*

Department of Physics, Raiganj University, Raiganj, West Bengal, India.

*Correspondence e-mail: purna.barman@gmail.com

Abstract

Liquid crystals are the intermediate states of matter in which the properties lie between those of the three dimensionally ordered solid crystals and completely disorder isotropic liquid. These intermediate states are known as mesophases. The molecules of various organic

compounds having shape anisotropy, which may be rods, discs and bent cores, can exhibit these types of phases. The phases can be characterized by a long range positional order of the center of mass of molecules as well as a long range orientational order of the principle axes of the molecules.

Keywords: Liquid crystals, mesophases, shape anisotropy.

Ph.056

Third application of Principia's third law of motion and role of shape of bodies

Ajay Sharma*

Fundamental Physics Society, His Mercy Enclave, Post Box 107 GPO Shimla
171001 Himachal Pradesh, India.

*Correspondence e-mail: ajoy.plus@gmail.com

Abstract

Newton stated third law or axiom of motion in *the Principia* in three similar statements which establish precise equality between action and reaction for bodies under all conditions i.e. universally. Newton did not give any mathematical equation thus explained the law qualitatively only. The action and reaction occur in pairs simultaneously and inherently. In first application Newton expressed action and reaction in terms of push or pull (force). In third application Newton expressed action and reaction in terms of momentum; which further implies reaction can be expressed in terms of velocity. In Newton's law, the action and reaction (force, momentum or velocity as follow from momentum) are independent of shape, characteristics etc. of projectile and target. It implies that if body is of mass 1kg, then it may have any shape (spherical, semi-spherical, cone, triangle, long pipe, umbrella shaped or flat etc.), then each body has same weight (mg) or action (when dropped from certain height). These elusive terms can be taken in account if the law is speculated i.e. action and reaction

are proportional to each other. The coefficient of proportionality takes the elusive terms in account. The Electromagnetic Drive experiments by NASA and in other laboratories have confirmed the forward thrust of the prototype without exhaust, which is violation of third law of motion. However experiments are needed for final confirmation. Further Newton has stated second law of motion, law of gravitation, law of cooling etc. in proportionality form. If the third law of motion is speculated in proportionality form (action and reaction are proportional to each other), the coefficient of proportionality accounts for elusive factors. The third application of third law of motion implies law of conservation of momentum. In elastic collisions in one dimension, both kinetic energy and momentum are simultaneously conserved. In both cases the shape, compositions are significant. Thus sensitive experiments are needed to confirm the effect of these factors.

Keywords: Third law, shape, characteristics, equations.

Ph.057

Investigation of some properties of phenyl-tolane liquid crystal compounds with NCS terminal group

S. Haldar*, B. K. Singha

Department of Physics, North Bengal University, Siliguri, India.

*Correspondence e-mail: nbushaldar@rediffmail.com

Abstract

Physical properties of six laterally fluorinated phenyl tolane liquid crystal compounds have been investigated. The dipole moment of these compounds are much higher than the phenyl bicyclohexyl compounds. The enhancement of threshold voltage is observed with decreasing fluorination into the compound. Lateral fluorine substitution enhances the dipole moment and thereby considerable decrease in threshold voltage. Compound 1 and 3 of series A show expected increasing behavior of Δn with increasing fluorine substituent whereas

compound 2 shows a drastic jump in $\Delta\alpha$ with a value of 11.31. Higher values of elastic constant (k_{11}) were found for compound 4 in series A. A lowering trend of k_{11} is found with fluorination in series B.

Keywords: Phenyl-tolane liquid crystal compounds, dipole moments, dielectric constant, splay elastic constant.

Ph.058

Verification of varying electrical charge to using trigonometric functions

Darshan K.V and S. Ghosh*

Department of Physics, Vijaya College, R. V Road, Bangalore-560004.

*Correspondence e-mail: gsovan@gmail.com

Abstract

Varying fine structure is one of the serious problems in recent day cosmology. A solution to this problem is possible using the suggestions provided by Bekenstein. This solution introduces a path breaking concept of time varying electrical charge so that the variation of fine structure can be countered. Here in this article different trigonometric functions are considered to play the role of the time-varying electrical charge. From the graphs corresponding to our calculations, small variations are noticed which are desired.

Keywords: Fine structure constant, time-varying electrical charge.

Ph.059

Ground state properties and decay modes of $Z = 118$ isotopic chain in superheavy region

G. Saxena*

Department of Physics (H&S), Government Women Engineering College,
Ajmer-305002, India.

*Correspondence e-mail: gauravphy@gmail.com

Abstract

To search for the possible fusion reactions and to identify potential superheavy nuclei is one of the eminent problems in the current world. Up to $Z = 118$, many superheavy nuclei have been produced either by cold fusion reaction with target ^{208}Pb and ^{209}Bi at GSI and RIKEN or by hot fusion with projectile ^{48}Ca at JINR. Theoretical prediction on the synthesis of superheavy nuclei with $Z = 118$ ($^{290-302}\text{Og}$) using ^{48}Ca , ^{45}Sc , ^{50}Ti , ^{51}V , ^{54}Cr , ^{55}Mn , ^{58}Fe , ^{59}Co and ^{64}Ni induced reactions have been made recently along with most probable projectile-target combinations are $\text{Ca}+\text{Cf}$, $\text{Ti}+\text{Cm}$, $\text{Sc}+\text{Bk}$, $\text{V}+\text{Am}$, $\text{Cr}+\text{Pu}$, $\text{Fe}+\text{U}$, $\text{Mn}+\text{Np}$, $\text{Ni}+\text{Th}$ and $\text{Kr}+\text{Pb}$.

Guided by various theoretical and experimental studies, we have applied relativistic mean field plus BCS approach for full systematic study of even and odd isotopes ($^{284 d''} \text{A} d''^{352}$) in the superheavy region with $Z = 118$ (Og). In our present investigation, we evaluate the binding energy, one- and two- proton and neutron separation energy, shell correction and density profile of even and odd isotopes of $Z = 118$ ($^{284 d''} \text{A} d''^{352}$). Further we investigate the possible decay modes of this region specifically α -decay, spontaneous fission (SF) and the β -decay and evaluate the probable α -decay chains.

The phenomena of bubble like structure or charge density distribution is also investigated in $Z=118$ isotopic chain with significant depletion fraction around 20%-24%, which increases

with increasing Coulomb energy and diminishes with increasing isospin (N/Z) values exhibiting the fact that the Coulomb forces are the main driving force in the central depletion in superheavy systems. Our results are in good agreement with the available experimental data and Finite Range Droplet Model (FRDM) calculations and prove the reliability of the theoretical formalisms used in this work.

Keywords: Superheavy nuclei, GSI, RIKEN, JINR, α -decay, spontaneous fission (SF), β -decay, isospin, Finite Range Droplet Model (FRDM).

Ph.060

Finite Element Simulation of Helmholtz Resonator with Temperature Gradient

Gouri Goutam Borthakur*

Department of Physics, Jorhat Institute of Science and Technology, Jorhat-10, Assam.

*Correspondence e-mail: borthakur.gg@gmail.com

Abstract

We have modeled and simulated a Helmholtz resonator resonating at 256 HZ, at small and large temperature gradient, using finite element method. The direction of applying temperature gradient is chosen to be the axis of a cylindrical resonator. The input pressure wave, the reflected wave, the temperature profile and the effect of temperature variation on incident and reflected waves are presented as contour plots. The results are compared with the case of a resonator with no temperature gradient.

Keywords: Finite element method, Helmholtz resonator, contour-plots.

Ph.061

A Review of MEMS Scale Piezoelectric Energy Harvesting Using Hydrodynamism

Jyoti Yadav*¹, D. P. Goyal², Deepak Chhabra³

¹Department of Physics, Indira Gandhi University, Meerpur, Rewari, Haryana, India

²Department of Physics, Vaish College, Rohtak, Haryana, India

³Department of Mechanical Engineering, University Institute of Engineering and Technology, Maharshi Dayanand University, Rohtak, Haryana, India

*Correspondence e-mail: decentjyoti7@gmail.com

Abstract

In this article, significant research projects on water-energy extraction by using piezoelectric materials are described and discussed with their proposed designs and experimental results. Piezoelectric materials convert mechanical strain energy into electric energy according to piezoelectric effect and vice-versa according to reverse piezoelectric effect. Such materials have been used for sensing and actuating applications at a wide range. Present article overviews the different ideas of piezoelectric energy harvesting using hydraulic pressure and provides a building block for future research work in the field of utilizing fluid vibrational energy.

Keywords: Energy harvesting, piezoelectric effect, piezoelectric materials, hydraulic pressure, fluid vibrational energy.

Ph.062

Quark structure seen through Clairvoyance is confirmed by nine dimensional space, time and consciousness model

S.S. Pokharna*¹, Narendra Bhandari², M.L. Kalra³, Rajmal Jain⁴, S.C. Pragya⁵

¹Space Applications Center (ISRO), Satellite Rd, Satellite, Ahmedabad, Gujarat 380015

²Science and Spirituality Research Institute, 804, Yash Aqua, Navrangpura,
Ahmedabad – 380009.

³Kota University, Swami Vivekananda Nagar Near Kabir Circle, MBS Marg, Academic
Block Rd, Kota, Rajasthan 324005

⁴Physical Research Laboratory (PRL), Dept. Of Space, Navrangpura,
Ahmedabad - 380 009

⁵Jain Vishva Bharati Institute (JVBI), Ladnun, Rajasthan – 341306.

*Correspondence e-mail: sspokharna15@yahoo.com

Abstract

Annie Besant and colleagues, over a century ago, visualized the fine structure of atoms of various elements, down to sub quark level, through an Indian meditational technique of Anima siddhi. This structure is now confirmed by a nine dimensional (3 dimensions each of space, time and consciousness) TDVP model. A value of 8.64 percent has been found for the average normalized difference between the number of “anu-” seen by Clairvoyants and the number of quantum units (electron mass units) calculated for 92 elements of periodic table available at that time. This provides credence to the clairvoyance and authenticates the existence of sub-quark types of particles.

Keywords: Atom, Quarks, anu-s, Quantum Units, Electron mass units, Clairvoyance, Ninety two elements, Nine dimensional model of science, TDVP model, Anima Siddhi, Rest masses of quarks, Consciousness, Jainism, Discrete reality, Non-local infinite reality.

Ph.063

Simulations of minerals by using of DFT based on atomic orbitals for linear Scaling

Vishal Shukla*¹, Mahnaz Fatima², Rahul Tripathi¹, Sanjeev Trivedi¹

¹Department of Physics, Mumtaz P.G College, Lucknow-226062.

²Department of Physics, Integral University, Lucknow-226026.

*Correspondence e-mail: shuklavishal1008@gmail.com

Abstract

The use of quantum mechanics strategies within the formalism of density purposeful theory requires a method to symbolize the electron wave features. We examine the use of strictly localized foundation features primarily based on atomic orbitals with the usage of plane waves for the have a look at of mineral residences and behaviour. Strictly localized capabilities permit the computational sources to scale linearly with the scale of the system, while plane-wave techniques scale extra as the cube strength of the gadget length, and because of this using localized features can be preferred for research of large sizes. We present take a look at results received from research of cation ordering in spinel, garnet and amphibole stages, the high-pressure displacive segment transition in cristobalite, and the intercalation of organic molecules into pyrophyllite. We conclude that using localized foundation sets gives a useful direction ahead for quantum mechanical research of big-scale mineral problems.

Keywords: Linear scaling, SIESTA, Density-functional Theory, Atomic Orbitals.

Ph.064

Why & How Mars Lost Its Atmosphere?

Ravindra D. Rasal*

Swami Ramanand Tirth Marathwada University, NANDED, Maharashtra - 431606.

*Correspondence e-mail: ravindrarasal3@gmail.com

Abstract

This paper is based on the possibility that intelligent creatures, human or superhuman, habituated the planet “Phaëthon” which once existed between Jupiter and Mars. It was crushed into the belt of asteroids. That ancient cosmic accident also deprived Mars of its atmosphere and water. Few “Phaëtheonists”, however, managed to migrate to Earth and cultivated civilization on Earth. This may be called biological consequence of Bode’s Law, because Johann Bode had deduced the relation for quantization of the planetary orbits.

Keywords: Quantization, orbits, genetic, evolution, terrestrial.

Ph.065

Effect of Solvent on the Thermodynamic Activation parameters of a solvolysis Reaction

Yogendra Kumar*

Nauli Inter College, Nauli, Ghazipur, Uttar Pradesh - 232338

*Correspondence e-mail: yogendra.ara@rediffmail.com

Abstract

For studying the effect of solvent on the thermodynamic activation parameters of a desired solvolysis reaction, the kinetic studies of the alkali catalysed solvolysis of Propyl Acetate in aqueous dioxan media of various compositions at temperatures ranging from 20 to 40°C have been carried out. The specific rate constant values were found to decrease with increasing proportion of dioxan at all the temperatures. The iso-composition activation energy E_C and iso-dielectric energy E_D were found to be changed in opposite direction to each other. Variations in thermodynamic activations parameters ΔS^* , ΔH^* and ΔG^* have also been evaluated and interpreted on the basis of specific solvation taking place in the reaction media.

Keywords: Acetate ester, Electrostatic effect, Iso-dielectric, Iso-composition, Activation parameters, Solvation phenomenon, Mobile transition state, Ion-molecular.

Ph.066

Effect of gravity on the motion of photons

Yogendra kumar*¹, Madan pal²

¹Deptment of Physics, V.S.P. Govt. (PG) College Kairana, Shamli,
Uttar Pradesh - 247774.

²Deptment of Mathematics, V.S.P. Govt. (PG) College Kairana, Shamli,
Uttar Pradesh - 247774.

*Correspondence e-mail: yohr@rediffmail.com

Abstract

Anything that has mass is affected by gravity. The effect of the Earth's gravitational field has only been observed for massive particles. In this paper we study the possibility of gravitational effect on the motion of photons and conclude that the gravity effects on a single-photon motion in some or many ways, and provides a means to correlate the equivalence of the energy of the photon and its effective gravitational mass.

Keywords: Quantum measurement, gravity, quantum optics, graviton, photon.

Ph.067

Synthesis of Cobalt oxide by Electrodeposition method for supercapacitors application

R. T. Patil, D. P. Mali, P. C. Pawar, V. J. Fulari*

Holography and Materials Research Laboratory, Department of Physics, Shivaji University, Kolhapur- 416004 (M.S.) India

*Correspondence e-mail: vijayfulari@gmail.com

Abstract

With the development of new energy resources energy storage attracts great interest supercapacitor. Supercapacitor can instantaneously provide higher power density than batteries and higher energy density than conventional capacitor. The present work demonstrates the preparation of cobalt oxide thin film via potentiostatic electrodeposition method. Constant cathodic potential of -1.0V vs Ag/AgCl has been applied for the synthesis of CoOH thin film. Electrode was annealed at 623K for 180 min. The cobalt oxide thin film were characterized by XRD, FT-IR, FESEM and EDS techniques. The cobalt oxide phase is confirmed from XRD and EDS analysis while electrochemical properties was studied by using CH instrument (CHI- 606). All the thin films are polycrystalline in nature. The electrochemical supercapacitive properties of cobalt oxide thin film were evaluated using cyclic voltammetry and pontetiostatic charge/discharge method. The charge/ discharge test showed that as prepared cobalt oxide thin films were serve as an ideal electrode material for supercapacitor.

Keywords: Cobalt oxide, thin film, Electrodeposition, Potentiostatic Deposition.

Ph.068

Modification in Porous M_nO_2 polyaniline composite using high energy electron irradiation for electrochemical supercapacitor

B.P. Relekar*^{1&2}, A. V. Fulari², G. M. Lohar³, V.J. Fulari²

¹Yashwantrao Chavan College of Science, Karad-415124 (MH), India

²Holography and Materials Research Laboratory, Department of Physics, Shivaji University, Kolhapur-416 004 (MH), India

³Lal Bahadur Shastri College of Arts Science and Commerce, Satara-415002

*Correspondence e-mail: bprelekar@gmail.com

Abstract

In present work an electron beam of 5 MeV energy is applied on MnO₂-polyaniline composite thin films with specific doses like 10 kGy, 20 kGy and 30 kGy etc. Again these films are examined for structural properties employing FT-Raman and FT-IR spectroscopy. The morphological properties were studied using scanning electron microscope, wettability using contact angle meter, electrochemical properties using the electrochemical impedance spectroscopy and supercapacitive properties using the cyclic voltammetry. After the electron irradiation, supercapacitance and stability are found to be increased.

Keywords: Supercapacitance, irradiation, 5 MeV energy etc.

Ph.069

Performance of copper oxide reduced graphene oxide composite for flexible electrochemical supercapacitor

G. M. Lohar*

Department of Physics, Lal Bahadur Shastri College of Arts, Science and Commerce,
Satara 415002

*Correspondence e-mail: gauravlohar24@gmail.com

Abstract

The CuO/RGO composite based nanomaterials developed for electrochemical energy storage devices. The modified Hummers method engaged for develop graphene oxide and CuO/RGO composite is produced adopting method of co-precipitation. The composite of CuO/RGO synthesized concerning different concentrations of CuO and RGO. The examined structural, morphological, electrochemical, and supercapacitance properties for CuO/RGO composite. Present work describes the development of cost-effective and high-performance CuO/RGO based nanomaterials for electrochemical energy storage devices. The CuO/RGO composite can be used as flexible supercapacitor devices.

Keywords: Graphene, supercapacitor, nanomaterials.

Ph.070

Synthesis and characterization of Cobalt oxide thin film using hydrothermal method for electrochemical supercapacitor

O. C. Pore^{1&2}, V. J. Fulari², G. M. Lohar^{*1}

¹Department of Physics, Lal Bahadur Shastri College of Arts, Science and Commerce,
Satara 415002

²Holography and Materials Research Laboratory, Department of Physics, Shivaji
University, Kolhapur-416 004 (MH), India

*Correspondence e-mail: gauravlohar24@gmail.com

Abstract

The supercapacitors are able to overcome the problems related to clean energy. In the present investigation Cobalt oxide thin films are synthesized using the hydrothermal method. After the synthesis of cobalt oxide, the structural, morphological, electrochemical and supercapacitor behavior have been studied. The X-ray diffraction spectroscopy, scanning electron microscopy, electrochemical impedance spectroscopy has been used to investigate structural, morphological, and electrochemical properties, respectively. The cobalt oxide based one dimensional nanomaterials are developed using the hydrothermal method.

Keywords: Cobalt oxide, hydrothermal, supercapacitor.

Ph.071

Synthesis of high surface area CdS thin films by SILAR for Supercapacitor Application

S. S. Patil, A. B. Farakate, K. A. Kadam, V. J. Fulari*

Holography and Materials Research Laboratory, Department of Physics, Shivaji University, Kolhapur- 416004 (M.S.) India

*Correspondence e-mail: vijayfulari@gmail.com

Abstract

In the 21th century, nanomaterials is the advanced properties in the energy storage application. Hence we have synthesized the nanostructure CdS thin film via a successive ionic layer adsorptions and reactions (SILAR) method. The formation of a CdS nanostructures and its structural, optical, surface morphological properties and elemental composition were studied by various characterization techniques. The cubic crystal structure of the CdS nanostructures was confirmed *via* X-ray diffraction and field emission scanning electron microscopy analysis. The photoluminescence spectroscopy measurements reveal the presence of defects in the as synthesized CdS nanostructures. However, the defect states are beneficial for the supercapacitor behavior. Therefore, the supercapacitor properties of the CdS nanostructures were studied using different electrolyte. The nanostructures was observed to play a crucial role in determining the supercapacitor performance of the devices. In particular, our CdS based supercapacitor showed a good specific capacitance compared to the SILAR synthesized CdS nanostructures. Due to the high specific capacitance could be a suitable candidate for energy storage materials.

Keywords: CdS, SILAR, Supercapacitor.

Ph.072

Morphological tuning of highly magnetic Fe₃O₄ nanoparticles prepared by hydrothermal method with different hydroxide (OH⁻) sources

R. R. Koli^{1&2}, D. P. Mali², U. M. Chougale², R. T. Patil², S. S. Patil², N. B. Wadkar², N. G. Deshpande¹, V. J. Fulari^{*2}

¹q-Spin Tech and Nanomaterial Laboratory, Department of Physics, Shivaji University
Kolhapur-416004 (M.S.) India

²Holography and Materials Research Laboratory, Department of Physics,
Shivaji University, Kolhapur- 416004 (M.S.) India

*Correspondence e-mail: vijayfulari@gmail.com

Abstract

Herein, the effect of various hydroxides, i.e., OH⁻ (pH enhancer) sources on size and shape of magnetite (Fe₃O₄) NPs (MNPs) were studied. The hydroxide (OH⁻) sources used in hydrothermal synthesis were 35% Ammonia solution (NH₄OH), Hexamine (C₆H₁₂N₄), ammonium acetate (NH₄CH₃CO₂), triethylamine, TEA(N(CH₂CH₃)₃). All the prepared samples shows highly magnetic magnetite (Fe₃O₄) phase which is confirmed from XRD analysis. The morphological and elemental analysis was done using FESEM and EDS techniques. The Presence of various functional groups was determined from FTIR spectroscopic analysis. The nanoplates with width greater than 100 nm and thickness in the range of 20 nm was observed for ammonia mediated MNPs while agglomerated microstructures were seen in case of MNPs prepared in presence of hex.

Keywords: Magnetite, hexagons, hydrothermal, anisotropic.

Ph.073

Dissociation energy of ground state of diatomic IrN molecule using correlation coefficients method

R C. T. Londhe*¹, P. B. Undre², K.N. Shivalkar¹

¹Department of Physics, Mahatma Gandhi Mahavidyalaya, Ahmedpur – 413515, India.

²Department of Physics, Dr. B. A. M. University, Aurangabad – 431004, India.

*Correspondence e-mail: londhct@gmail.com

Abstract

Dissociation energy is an important parameter in the field of diatomic molecular spectroscopy. There are several experimental techniques to determine the dissociation energies of molecules. Besides these, there are few theoretical methods which are based on potential energy curves. The statistical method, correlation coefficient is used for this purpose. The correlation is obtained between RKR and the Hulber-Hirschfelder potential functions. The dissociation energy for the $X^1\dot{O}^+$ electronic ground state of IrN molecule estimated which is 6.26 eV and is close to the experimental value.

Keywords: IrN molecule, dissociation energy Potential energy curve, correlation coefficients.

Ph.074

Homotopy Perturbative Analysis of Relativistic Quantum Plasma Waves

Chinmay Das*, Swarniv Chandra

Govt. General Degree College at Kushmandi, Dakshin Dinajpur, India, W.B. - 733121

*Correspondence e-mail: chinmaydas.mtmh@gmail.com

Abstract

We consider a two-dimensional plasma consisting relativistically degenerate electrons and stationary ions. The electrons follow the Chandrasekhar distribution for relativistic degeneracy, we further consider a streaming of particles perpendicular to the magnetic field. We next analyze the governing equations by homotopy perturbative technique with different initial conditions. We obtained the time evolution of density and electric field. The problem has direct application in laser plasma interaction and other type of perturbations caused by the employment of external electric field. The results will be helpful to explain many possible nonlinear wave phenomena observed and reported nowadays. This homotopy perturbative method provides with exact solutions to physical problems.

Keywords: Relativistic degeneracy, homotopy perturbative technique, laser plasma interaction.

Ph.075

Arbitrary Amplitude Electrostatic Waves in Finite Temperature Fermi Plasma

Dayita Bhattacharjee*¹, Debapriya Nandi², Chinmay Das³, Swarniv Chandra³

¹JIS University, Agarpara, Kolkata, WB, India, 700109

²Modern Institute of Engineering & Technology, Bandel, India, W.B.712123

³Government General Degree College at Kushmandi, WB, India, 733121

*Correspondence e-mail: dayitabh17@gmail.com

Abstract

The study of electrostatic waves in a quantum plasma at finite temperature containing relatively warm electrons, non-degenerate cold electrons and stationary ions has been carried out by using nonlinear analysis. A linear dispersion relation is derived for electron acoustic waves. The change in density of electrons for various parameters has been observed using Sagdeev's pseudo potential approach. The formation and properties of large amplitude solitary structure is thus investigated. The present analysis may be important to understand the collective interaction in finite temperature quantum plasma. The results match with the earlier findings under limiting conditions.

Keywords: Quantum plasma, electron acoustic waves, pseudo potential approach.

Ph.076

Estimation of Iron Impurity Transport Parameters in Aditya Tokamak Plasma

A. K. Srivastava*¹, S. Patel², M. B. Chowdhuri³, R. Manchanda³ and J. Ghosh³

¹Birla Institute of Technology, Mesra, Jaipur Campus, Jaipur (Raj.), India-302017

²Pandit DeenDayal Petroleum University, Gandhinagar (Gujarat) -382007

³Institute for Plasma Research, Bhat, Gandhinagar (Gujarat). India-382428

*Correspondence e-mail: anand_ipr@yahoo.co.in

Abstract

Tokamak is a toroidal device used to facilitate the controlled nuclear fusion by magnetic plasma confinement process at high temperature. In tokamak, the plasma facing components is being replaced by high-Z material than earlier graphite considering they have higher power handling capacity. Medium and high-Z gases are injected into the edge and diverter region for better plasma properties. Then, there is renewed interest to understand medium and high-Z impurity behaviour in tokamak. This work aimed to study of the medium and high-Z impurity transport in Aditya tokamak.

We have carried out investigations of iron impurity behaviour using one-dimensional impurity transport code 'STRAHL' for vacuum ultraviolet (VUV) spectral emission at 28.41 nm from Fe¹⁴⁺ and 33.54 nm and 36.08 nm from Fe¹⁵⁺ impurity ions. The photon emissivity coefficients (PEC) required for this analysis were obtained by ADAS code. Modelling was done to estimate the transport properties by finding the ratio of convective velocity 'v' to the diffusion coefficient 'D'. The matching between experimental and calculated data was done with 10% accuracy. It is found that nature of Iron impurity transport is neo-classical in the central (core) region of the ADITYA tokamak plasma. We have also done the preliminary analysis to predict the radial profiles of diffusion parameters for possible electron density and temperature profile in tokamak plasma. Important results of our studies are presented.

Keywords: Impurity transport, iron impurity, tokamak plasma, nuclear fusion, plasma spectroscopy.

Ph.077

Utilization of solid and gaseous plasma

A.B. Gautam*

Dept. of Physics. S. B. A. N. College, Derhetta – Lari, Gaya, Bihar - 804421

*Correspondence e-mail: ramakant.pandey951@gmail.com

Abstract

Conversion of energy into transitional states and further settle down to culmination into ionic or any form of recognized mater which may not be defined as stable form of energy because this state is neither energy nor complete mater. On this topic studies were started from 1st January (2016). Some results and observations were recorded and published time to time but these works and their conformations were found further review and urgent need of massive research. It is known to all that plasma Physics were engaged and major role in the branches of many contemporary Physics like atomic physics, life sciences, chemical sciences and molecular Physics for heavy industries. It may affect socio-economic development of now as well as future generations of human society.

Keywords: Transition state, solid plasma & gaseous plasma.

Ph.078

Exploring the environment of a black hole

Gobinda Chandra Das*

Vil-Saguna, P.O- Saguna, Dist- Nadia, West Bengal - 741245

*Correspondence e-mail: gcd.csms.1729@gmail.com

Abstract

Black holes have mass, which causes gravitational force, which effects objects near them. This gravitational force would be very strong near the black hole and could have noticeable effects on its environment. The physical environment around a black hole is complicated with gas flowing in, energy being released. This paper is devoted to the study of the limiting value of orbital velocity of an object near the black hole Cygnus X-1, black holes and gas temperature, black holes and accretion disk temperatures, radius of event horizon of a supermassive black hole, evaporating black holes, and black hole thermodynamics. Studies are done mathematically.

Keywords: Black Holes, Environment, Temperature, Accretion Disk, Event Horizon.

Ph.079

Impact of Preparation Method on Electrical and Magnetic Properties of Spinel Ferrite Nanoparticles

Shilwant J. S.*¹, More S. D.²

¹Dept. Of Physics, Dr. Babasaheb Ambedkar Marathwada University,
Aurangabad (M. S.) India

²Dept of Physics, Deogiri College Aurangabad (M. S.) India

*Correspondence e-mail: shilwantj@gmail.com

Abstract

Recent developments and trends of sol–gel auto-combustion method for spinel ferrite nanomaterial synthesis are briefly discussed and critically analyzed. The analysis of various electrical and magnetic properties for understanding impact of synthesis process of spinel ferrite nanoparticles are the main objective of this work. Special attention was paid to variety of particle size and phase purity. For these purposes the correlation between complexant, oxygen balance and combustion process chemical additives, as well as heating mechanism are established. These results are relevant from standpoints of both application and processing of ferrites.

Keywords: ferrite, synthesis, sol–gel, auto-combustion, nanoparticles.

Ph.080

Two Stream Instability in Two Temperature Electron Plasma with Viscous Effect

**Subhangi Chakraborty¹, Joyeesha Manna¹, Debanjali Roy¹,
Jyotirmoy Goswami^{*1&2}**

¹Department of Physics, JIS University, 81, Nilgunj Rd, Kolkata 700109

²Department of Physics, Jadavpur University, Jadavpur, Kolkata-700032

*Correspondence e-mail: jyotirmoygoswami09@gmail.com

Abstract

In this paper the electroacoustic two-stream instability is investigated for a large range of plasma number density using the quantum hydrodynamic model in presence of two temperature electron. Such plasmas are often found in dense astrophysical bodies like white dwarfs, neutron stars etc. The effect of finite temperature, Bohm potential and viscosity coefficient have been thoroughly investigated in this paper. Current study can help in better understating of electron-beam plasma interactions for big planetary cores and compact stars.

Keywords: Electroacoustic two-stream instability, quantum hydrodynamic model, finite temperature, Bohm potential, viscosity coefficient.

Ph.081

Structural variations of CdSe thin films with deposition parameters related to techniques of deposition

Kangkan Sarmah*, Ranjan Sarma

¹Department of Physics, Mangaldai College, Mangaldai – 784125

*Correspondence e-mail: ks_guphys@rediffmail.com

Abstract

Two techniques mainly physical vapour deposition (PVD) and chemical bath deposition (CBD) were used for making CdSe thin films. XRD technique was used for structural analyses of the deposited films. SEM technique and EDAX analysis were used for the morphological studies of the films. With the change of individual deposition parameters of the films large scale variation of crystalline size had been observed in case of both the deposition techniques. For chemically deposited films variations of crystalline sizes were studied with the change of molarity of the deposited solution whereas in case of physically deposited films the same study had been conducted for the variation of substrate temperature of deposition. CBD technique is mainly found to be helpful for the deposition of films with smaller crystalline size whereas PVD technique is generally found to be suitable for the deposition of films with larger crystalline size.

Keywords: CdSe thin films, Substrate temperature, Molarity.

Ph.082

Semiconductor Behavior in Crossed High External Electric and Magnetic Fields

Madan Jee, Manish Kumar Bhatt*, Sanjeev Kumar, Sunil Kumar Mishra

¹Department of Physics, B.R.A. Bihar University Muzaffarpur, Bihar India – 842002.

*Correspondence e-mail: m.k.bhatt05@gmail.com

Abstract

The problems of inefficiency of inter electronic collision in quantizing magnetic field have been solved by taking into account the mutual drag of electrons and photons. Mutual drag leads to renormalization of the cyclotron frequency of carriers dressed by the phonons. The phonon generation at high external electric and magnetic field is a non-stationary effect. Non equilibrium equation for the density matrix of phonons interacting with electrons have also been obtained. The distribution of electrons and phonons are obtained as a result of the solutions coupled system of equation for the density matrix of interacting electrons and photons for arbitrary heating and drift velocity is of phonons. The distribution function of four phonon is a stationary and has the shifted Planck's distribution function from the effective temperature of phonons.

Keywords: phonons, semiconductors, drift velocity, quantization, coupled piezoelectric.

Ph.083

Behavior of Wigner Molecule in External Magnetic Field

Sajiv Kumar, Manish Kumar Bhatt*, Sunil Kumar Mishra

¹Department of Physics, B.R.A. Bihar University Muzaffarpur, Bihar India – 842002.

*Correspondence e-mail: bhattmanish05@gmail.com

Abstract

In the above topic it was studied the phase transitions in Wigner molecules Induced by an external magnetic field. The symmetry of the Wigner molecule phase that emerges from the maximum density droplet phase, is different from the classically obtained values. The existence of several phase of wigner molecule with different symmetries should be observed in the magnetic field above the maximum density droplet breakdown transition.

Keywords: Density droplet, Wigner molecule.

Ph.084

**Investigation of Thermoacoustical, Rheological, Spectroscopic
and Quantum Simulation of Polypropylene glycol diol 3000 (PPG)
with 1-Butanol and 1- Pentanol**

Sachin Gupta and Manisha Gupta*

Department of Physics, University of Lucknow, Lucknow 226007, India.

*Correspondence e-mail: guptagm@rediffmail.com

Abstract

Thermodynamic phenomenon of Polypropylene glycol diol 3000 (PPG-3000) with 1-butanol and 1-pentanol has been examined through thermoacoustic, spectroscopic and density functional theory. Ultrasonic velocity along with refractive index, density and viscosity of binary mixtures have been measured at temperature $T = 293.15$ K, 303.15 K and 313.15 K for the entire range of composition. From these experimental data, deviation in ultrasonic velocity (Δu), deviation in viscosity ($\Delta \eta$), deviation in molar refraction (ΔR_m), excess intermolecular free length (L_f^E), and Gibb's free energy of activation of viscous flow (ΔG^{*E}) have been evaluated to study the interaction between the unlike molecules of liquid mixtures. FT-IR, UV-visible spectroscopic and quantum simulation by DFT have been investigated to study molecular scale interactions. The deviations in different parameters show hydrogen bonding of varying strengths between constituents of these mixtures.

Keywords: Ultrasonic velocity, viscosity, spectroscopy, quantum simulation.

Ph.085

Phase shifts for positron-helium ion elastic Scattering

Mukesh Kumar Sinha*¹, Ashish Verma² and Rajesh Ranjan Kumar³

¹Department of Physics, L.N.J.P.Institute of Technology, Chapra – 841302, Bihar.

²Department of Electronics, G.P. Vaishali- 844118, Bihar.

³Department of chemistry, Shershab College of Engg., Sasaram-821308, Bihar.

*Correspondence e-mail: mukeshphysics11@gmail.com

Abstract

We investigate elastic scattering of positrons by helium ions using distorted wave method. Phase shift for positron-helium ion elastic scattering have been calculated. Phase shift with potential of Callaway and potential of Temkin-Lamkin have been used. The present results have been compared with corresponding results ζ_c and ζ_{TL} of Khan, Mazumdar and Ghosh. We have used the distorted wave method that account for the effect of continuum. In this method, we included a part of Coulomb potential in continuum wave function in the initial channel. The nucleus of the target atom has been taken as screened nucleus. The polarization potential has been included which account for few excited states.

Keywords: Elastic scattering, positrons, helium ion, phase shift.

Ph.086

**Study of Corrosion Inhibitor properties of bio-waste Garlic Peels
as green corrosion inhibitors**

Rekha Garg Solanki*

Dr. H.S. Gour University, Sagar, M.P, India - 470003.

*Correspondence e-mail: gargrekha25@rediffmail.com

Abstract

Chemical or electrochemical interaction of environmental factors to the materials like iron, copper etc. corroded the material and may reduce the mechanical and physical properties. Iron, due to its mechanical properties, low cost and low corrosion resistance, is widely used in industry. Corrosion reduces the performance and useful life of engineering products. It creates a serious economic and environmental impact in all infrastructure sectors, such as roads, oil and gas pipelines, water supply, sewage etc.

Generally, Benzotriazole (BTAH) is widely used as corrosion inhibitor for iron and copper. But BTAH has toxic effect towards humans and environment. Hence, researchers focus on the search of natural corrosion inhibitors, which are extracted from plants, seeds, natural herbs and medicinal plants. The bio-wastes are biodegradable, sustainable, easily available, environment friendly and economic substances. The garlic skin is also known as Garlic Peels, generally thrown to the environment by households/farmers as garbage or burnt causes environment pollution. In this work, we are focused on the utilization of the bio-waste garlic peels for the protection of iron from corrosion as a corrosion inhibitor. We are extracted garlic peels and try to find its corrosion inhibitor properties for iron against acidic media.

Keywords: Bio-waste, garlic peels, corrosion, green corrosion inhibitor.

Ph.087

Synthesis and Characterization of Bi_{0.9}Nb_{0.1}FeO₃ multiferroic nanoparticles

Sunil Kumar Mishra*¹, N.K.Singh², Manish Kumar Bhatt³, Sanjiv Kumar³

¹Department of Physics, L.P.Shahi Inter College, Muzaffarpur, Bihar - 843113

²Department of Physics, V. K. S. University, Ara, Bihar – 802301

³Department of Physics, B. R. A. Bihar University, Muzaffarpur, Bihar - 802301

*Correspondence e-mail: sunilmishra.phy@gmail.com

Abstract

Polycrystalline samples of Bi_{0.9}Nb_{0.1}FeO₃ (BNFO) were prepared in air by the conventional solid state reaction method. Preliminary X-ray structural analysis (XRD) of the compound shows that it has been formed in single phase rhombohedral structure at room temperature, accompanied with a tiny residual Bi₂O₃ phase. SEM studies reveals that the sample has spherical morphologies with uniform diameters of about 25 nm. Detailed studies of dielectric constant and loss as a function of temperature at 100 kHz suggest that ceramic is high T_c ceramics. Study of the nature of magnetic ordering (T_c), there is a decline in magnetization in the sample. The transition below T_c shows a broad nature, showing the typical canted ferromagnetic nature derived from the antiferromagnetic ordering.

Keywords: Perovskite, Ferroelectric, Solid-state reaction.

Ph.088

**Studies on changes in the Thermodynamic activation parameters
of the alkali catalyzed hydrolysis of benzyl butyrate in aquo-dioxan
Reaction media**

Om Prakash Upadhyay and R.T. Singh*

Department of Physics, V. K. S. University, Ara, Bihar – 802301

*Correspondence e-mail: ysingh01031982@gmail.com

Abstract

The kinetics of alkali catalyzed hydrolysis of benzyl butyrate was studied in aquo-dioxan (Dioxan being dipolar aprotic solvent) media. It has been observed that “H* and “S* of the reaction were found to increase simultaneously with increase in “G* values and from this, it has been inferred that initial state of the reaction is enthalpy dominating and entropy inhibiting. From the evaluated numerical values of the Iso-kinetic temperature of the reaction which comes to be 326, it is concluded that there is strong and appreciable interaction between solvent and solute in water-Dioxan reaction media.

Keywords: Benzyl butyrate, Dipolar aprotic, Activation parameters, food additive, Iso-kinetic temperature.

Ph.089

Study of the Fractal Nature of Geological Contours

S.Q.Chishty*¹, Mhod Khizar², Raje Shiakh B.B³

¹Department of Physics, Dr. Rafiq Zakaria College for Women Navkhanda Aurangabad
M.S - 431001

²Department of Physics, Kohinoor College of Arts Science and Commerce Khultabad.
M.S - 431101

³Department of Physics, Govt College of Arts Science Aurangabad. M.S

*Correspondence e-mail: chishtysq@gmail.com

Abstract

In the present study contours from local hill area 'Chaalisgaon' area in Jalgaon district (M.S). These contours are plotted by taking the scale as 1 cm = 500m. Using leveling instruments. The contour shapes are studied with reference to the fractal geometry. As the contours are closed forming irregular shapes these shapes are digitized and analyzed using the box counting technique. Their fractal dimensions are calculated.

Keywords: Box counting, Contours, Dimensions, Fractal.

Ph.090

Space culture: Feeding food for space travelers

Janhavi, V.¹ and Manjunathgowda, D.C.*²

¹Department of Physics, Bengaluru North University, Tamaka, Kolar, Karnataka,
India – 563103.

²ICAR-Directorate of Onion and garlic Research, Rajgurunagar-410505, Pune,
Maharashtra, India

*Correspondence e-mail: dcmgowda@gmail.com

Abstract

Plants of differential growth responses to gravity know as gravitropism, all the geotropic plants were familiar to human by the nature of their use. However, the plants can also grow successfully in low gravitational force, micro gravity and with no gravity too. This is most important in this era of science to focus on supply of food feed as live healthy greens to the space travelling astronauts during prolonged spaceflight. Hence, the space culture will benefit to provide food in spacecraft. The efforts to grow agricultural or horticultural plant from seed to seed in space have limited success. In this view, the development of technology being worth pursuing to prepare space activities, with potential low, micro- gravity or no gravity components within the closed plant growth system with nutrient delivery system. However the plant like lettuce, cabbage, cauliflower, amaranths, radish, turnip, endive, Swiss chard, dandelion, New Zealand spinach and other vegetables were under way evaluation for their suitability to the space culture.

Keywords: Space, Gravity, Agriculture, Horticulture.

Ph.091

Earth Centered Gravitins in the Inner and the Outer Cores

Kotcherlakota Lakshmi Narayana*

17-11-10, Narasimha Ashram, Official Colony, Maharanipeta. P.O., Visakhapatnam-530002, Andhra Pradesh

*Correspondence e-mail: truscience.rutechnology@blogspot.com

Abstract

Both the Inner and the Outer cores of the Earth are considered to have the Gravitins, a totally new concept. The Inner core, with radius 1216 km, has the Iron, Nickel, Sulphur and Magnesium with 10% other minor metals and has the mass 13000 kg/m^3 with Density $0.98 \times 10^{23} \text{ kg}$. It has about 2.277×10^{24} Gravitins. On the other hand, the Outer core, with a radius of 2270 km, has only smaller mass of 3000 kg/m^3 with density 1.47 kg, in a liquid state. Both the Inner and the Outer cores, have freely moving $4s^2$, $4s^2$, $3s^2$, $3s^2$ electrons and both the cores are devoid of any magnetic field. Outer core has about 3.4167×10^{24} Gravitins. The freely moving electrons are combined with the Gravitins.

Keywords: Gravitins, electrons, minor metals.

Ph.092

Influencing Parameters on Dielectric behavior of Sb⁵⁺ Substituted Lithium Ferrites

M.V.K. Mehar*¹, K. Samatha²

¹Department of Physics, P.R. College (A), Kakinada, E. G. Dt.,
Andhra Pradesh – 533001

²Department of Physics, Andhra University, Vishakhapatnam, Andhra Pradesh - 530003

*Correspondence e-mail: drmvkm@gmail.com

Abstract

High valency Sb⁵⁺ substituted lithium ferrite with general formula [Li_{0.5+x}Sb_xFe_{2.5-2x}]O₄: where 'x' =0.0 to 1.0 in steps of 0.1 were prepared under solid state reaction method sintered at high temperature 1200°C. The dielectric behavior of all the samples were studied from 50 -10⁶Hz. The dielectric constant initially increases up to at x= 0.6 from where it is decreases which is due to space charge polarization. The dielectric constant shows similar behavior with frequency variations and dielectric constant values lie in between 30-100 at MHz frequencies which is explained with reduction of Fe²⁺ and Fe³⁺. The dielectric loss is very low value (below 1) at high frequencies due to hopping frequency.

Keywords: Lithium ferrites, Dielectric behavior, conduction Mechanism.

Ph.093

Effect of Ce-substitution on the structural and electrical properties of yttrium iron garnet nanoparticles powders prepared by sol-gel auto-combustion method

**Rameshwar B. Borade¹, S.B. Kadam², A.S. Gaikwad³, S.S. Satpute⁴, S.T. Alone⁵,
A.B. Kadam^{*6}**

¹Department of Physics, Ankushrao Tope College, Jalna, MS, India

²Department of Physics, L.B.S. college, Partur, Jalna, 431501, MS, India

³Department of Physics, Vivekanand College, Aurangabad 431001, MS, India

⁴Department of Physics, Shrikrishna Mahavidyalaya, Gunjoti,
Osmanabad 413613, MS, India

⁵Department of Physics, Rajasrshi Shahu College, Pathri, Aurangabad, MS, India

⁶Department of Physics, Jawahar Art Science and Commerce College, Andur,
Osmanabad, MS, India

*Correspondence e-mail: drabkadam@gmail.com

Abstract

Ce-substituted YIG $Y_{3-x}Ce_xFe_5O_{12}$ ($x = 0.0, 0.5, 1.0, 1.5, 2.0$) powder prepared by sol-gel auto-combustion method. The XRD results confirmed the formation of a garnet structure. The XRD result shows that the calculated lattice parameter increase for $x = 0.5$ of cerium composition. The decrease of lattice parameter is due to the substitution of Ce^{3+} with the smaller Y^{3+} . The lattice parameter decreases for $x \geq 0.5$ with increasing Ce^{3+} composition. The average crystallite sizes of powders decreased from 24-22 nm with increasing the Ce^{3+} , which are estimated from the Scherer's equation. The average grain sizes are in the range of 50-90 nm, which are observed from the FE-SEM. The dielectric parameters follow the Maxwell–Wagner interfacial polarization. It was observed that both dielectric constant and dielectric loss decreases with applied frequency whereas AC conductivity increases with applied frequency.

Keywords: Synthesis, Ce-substituted YIG, structural, dielectric properties.

Ph.94

Magnetic Photon Theory (A physical model for the structure of a Photon)

Rangaiah Karavadi*

Andhra Bank, Andhra Pradesh, India.

*Correspondence e-mail: rangaiahkaravadi@gmail.com

Abstract

This paper presents a new theory on nature of light and its properties. It proposes a physical model for the structure of “Photon” for its emission and radiation. It describes the radiation as a spherically expanding and spirally moving multilayer magnetic shell, which gives linear wave effect for the light photon. It also shows how the wave doesn’t need any media for its travel and describes the hidden force that causes the light photon to move. It also explains as to how the photon gets its frequency and how that frequency is transverse in nature. Further, as against to the existing belief that the “em” wave contains two components one Electric and the other Magnetic, this theory says that it contains only one component i.e. Magnetic component.

Most of the space around the nucleus in an atom is believed to be empty. But this theory says that it is not empty; it is filled with magnetic field in the form of magnetic rings in addition to electrons and other subatomic particles.

If this photon theory turns out to be correct, it gives a clear picture for the structure of photon and gives way for deeper understanding of the structure of Atom.

Keywords: Photon, Magnetic shell, magnetic rings.

Ph.95

Electrical and structural properties of fibres of plant *Alstonia scholaris*

Ranjan Sarma¹, Kangkan Sarmah¹ and Sahabuddin Ahmed²

¹ Department of Physics, Mangaldai College, Mangaldai-784125, Assam, India.

² Department of Botany, Mangaldai College, Mangaldai-784125, Assam, India.

*Correspondence e-mail: ranjan.guphys@gmail.com

Abstract

In an effort to utilize a plant for extracting natural polymers i.e fibres of *Alstonia scholaris* (*Apocynaceae*) is chosen for the study. Compressed and dried 950 micron thick sheets prepared from fibres of *Alstonia scholaris* plants are found to be composed of polycrystalline grains. These samples are found to possess electrical and structural properties similar to other already studied plant fibres. In the present study some electrical and structural properties of this sample has been analysed in fresh and after prolonged annealed conditions. There exist possibility of realizing commercially viable products prepared from these fibres.

Keywords: *Alstonia scholaris*, Polycrystalline grains.

Ph.96

Nano Yttrium Iron Garnate for Microwave applications

S.K.S Parashar*¹, Kajal Parashar¹ and Rishu Prasad²

¹Nanosensor Lab, School of Applied Sciences, Kalinga Institute of Industrial Technology (KIIT), Deemed to be University Bhubaneswar-751024, India.

²School of Civil Engineering, Kalinga Institute of Industrial Technology (KIIT), Deemed to be University Bhubaneswar-751024, India.

*Correspondence e-mail: sksparashar@yahoo.com

Abstract

In this experiment Yttrium Iron Garnet was synthesized by high energy ball milling technique followed by sintering. Further the nanostructured Yttrium Iron Garnet (YIG) was obtained and YIG was doped in PVA matrix and its thin film was prepared. The YIG doped PVA thin film was fabricated for different concentrations of 0.1%, 0.5% & 1%. Vector Network Analyzer was employed for Characterization of the material and for understanding different materialistic and microwave properties of the prepared thin film. The measurement was done in the frequency range of 9-11.5 GHz in X-Band and effective results were obtained. Results shows that the magnetic materials are very useful for microwave applications.

Keywords: Yttrium Iron Garnet, Dielectric Constant, Dielectric loss.

Ph.97

Numerical and Analytical Investigation of Thermosolutal instability in a compressible viscoelastic Walters' (model B') fluid in the presence of uniform magnetic field in porous medium

Sanjeev Kumar*

Department of Mathematics, Vallabh Govt. College Mandi Dist., Mandi- 175 001,
Himachal Pradesh, India.

*Correspondence e-mail: sanjeev.gcm@gmail.com

Abstract

The thermosolutal instability in a compressible fluids through a porous medium in the presence of magnetic field is examined for viscoelastic polymeric solutions. These solutions are known as Walters' (model B') fluids and their rheology is approximated by the Walters' (model) constitutive relations, proposed by Walters' (1962). The compressibility, stable solute gradient and magnetic field are found to have stabilizing effect. The medium permeability has a destabilizing effect in the presence of magnetic field on the system. Also, the dispersion relation is analyzed numerically and the results shown graphically. The oscillatory modes are introduced in the presence of stable solute gradient and magnetic field which were non-existent in their absence. The conditions for the non-existence of overstability are also obtained.

Keywords: Thermosolutal convection, Elastico-viscous Walters' (model B') fluid, Viscoelasticity, Compressibility, Magnetic field, Porous medium.

Ph.98

Dielectric and Conductivity studies in V_2O_5 - B_2O_3 - P_2O_5 Glasses

T. Sujatha, Amarkumar Malge, T. Sankarappa* and J.S. Ashwajeet

Department of Physics, Gulbarga University, Gulbarga 585106, Karnataka, India.

*Correspondence e-mail: sankarappa@rediffmail.com

Abstract

Transition metal oxide (TMI), V_2O_5 doped borophosphate glasses were synthesized by melt quenching method at 1400K in an electric furnace and annealed at 500K. Samples were confirmed to be non-crystalline by XRD studies. They were investigated for dielectric properties as a function of frequency and temperature. Dielectric constant and loss decreased with increasing frequency and, increased with increasing TMI content. The total conductivity estimated from dielectric data has been analyzed using Jonscher's universal power law. Frequency dependent part of the conductivity and its frequency exponent were determined. Frequency exponent was found change with temperature. Conductivity increased with increasing V_2O_5 content. Mott's polaron hopping model has been employed and activation energy for ac conduction has been determined at different frequency. Activation energy decreased with V_2O_5 .

Keywords: Transition metal ions, borophosphate glasses, dielectric properties, ac conductivity, activation energy.

Ph.99

Investigations of intermolecular interactions between 1, 2-Diaminopropane - Aminoethanol through dielectric relaxation study

V. L. Jadhavpatila*¹ and P. B. Undreb²

¹Microwave research Laboratory, Deogiri College, Aurangabad-431001.

²Microwave Research Laboratory, Department of Physics, Dr. B.A.M. University, Aurangabad-431004, India.

*Correspondence e-mail: van_desh@yahoo.com

Abstract

The complex permittivity spectra of 1, 2-Diaminopropane - Aminoethanol, were determined in the frequency range of 10 MHz to 20 GHz using time domain reflectometry (TDR) at 293 K for 11 different concentrations of the systems. The dielectric parameters viz. static permittivity (ϵ') and relaxation time (τ) have been obtained by the least squares fit method. A vibrating tube Densimeter, type Anton Paar DMA55, was applied for densities measurements. From the experimental data excess permittivity (ϵ'^E), excess inverse relaxation time $(1/\tau)^E$ and excess molar volumes (V^E) have been calculated and studied. The Redlich-Kister equation was used to fit the experimental (ϵ'^E), $(1/\tau)^E$ and (V^E) data. Their behavior strongly suggests the existence of intermolecular interactions.

Keywords: Aminoethanol, density, excess properties, static permittivity, relaxation time, 1,2-diaminopropane.

Ph.100

Synthesis of Ni-substituted Mn-Zn ferrite nanoparticles

F.A. Ahmed and L.N. Singh*

Department of Physics, Dr. Babasaheb Ambedkar Technological University, Lonere,
Raigad - 402103, M.S., INDIA

*Correspondence e-mail: lns2k@yahoo.com

Abstract

$\text{Mn}_{0.5-x}\text{Ni}_x\text{Zn}_{0.5}\text{Fe}_2\text{O}_4$ ($x=0.0, 0.1, 0.2, 0.3$) ferrite nanoparticles were synthesized by sol-gel technique. The structural and magnetic properties were studied by using X-Ray Diffraction (XRD), Scanning Electron Microscope (SEM) and Vibrational Sample Magnetometer (VSM) technique. The XRD patterns confirm the synthesis of single phase ferrite nanoparticles for all the samples. The lattice parameters were observed in the range of $8.414\text{\AA} - 8.337\text{\AA}$. The SEM images reveal the morphology of powder was porous and agglomerated. It has been observed that saturation magnetization increases up to $x=0.1$ and then decreases.

Keywords: XRD, sol-gel, VSM, nanoparticles.

Ph.101

Effect of thickness on non-enzymatic glucose sensing performance of CuO thin films

A. S. Patil, R. T. Patil, V. J. Fulari*

Holography and Materials Research Laboratory, Department of Physics, Shivaji University, Kolhapur-416 004 (MH), India

*Correspondence e-mail: vijayfulari@gmail.com

Abstract

In the present study, copper oxide thin films are synthesized using the successive ionic layer adsorption and reaction (SILAR) method onto the stainless steel (SS) substrate. Prepared thin films have been analyzed for their structural and morphological behavior. X-ray diffraction analysis is used to study structural properties like formation of phase, crystallite size, and crystal structure. Field emission scanning electron microscopy is used to study morphological properties. The prepared CuO has been used as an electrode for non-enzymatic glucose sensor. The XRD study shows that prepared copper oxide thin films exhibits polycrystalline structure with monoclinic nature. FE-SEM study reveals that the prepared copper oxide exhibits needle like nanostructures.

Keywords: Copper oxide, SILAR, X-ray diffraction, FE-SEM, Cyclic voltammetry, Chronoamperometry etc.

Ph.102

Study of positive parity energy bands of ^{167}Lu

Rani Devi* and Shivali Sharma

Department of Physics, University of Jammu, Jammu-180006, India.

*Correspondence e-mail: rani_rakwal@yahoo.co.in

Abstract

In the recent years, there has been much interest to study the nuclear structure properties of proton-rich Lutetium nuclei. These nuclei lie in the rare earth region and are known to be prolate deformed in their ground states. Recently, complete spectroscopy of ^{167}Lu has been investigated by using Gammasphere array and eighteen energy bands have been obtained. Out of these eighteen energy bands, ten bands are of positive parity. To interpret these energy bands theoretically by using one theoretical framework is a challenge for theorists. Therefore, in the present work, the low-lying positive parity bands of ^{167}Lu are studied by using projected shell model approach. The band head energies, transition energies and moment of inertia of positive parity bands are obtained and compared with experimental data. The theoretical results support the axial character of some of these bands at low-spin.

Keywords: Projected shell model, positive parity bands, transition energies.

Ph.103

Memory of water as a Nonlinear Phenomenon

B.V. Baby*

Halkal, Jadkal P O, Udupi Dist – 576233, Karnataka State, India.

*Correspondence e-mail: drbaby.db@gmail.com

Abstract

Memory of medicine content in the ultra-dilution of water is studied by a theoretical model based on the “tunneling effect” of the double well potential of nonlinear integrable dynamical systems. The soliton type high stable nano particle like solution of such system is used for storing the memory and called as ‘Homoeons’. The whole above theoretical study based on the assumption that the dynamisation of homoeo drug as a nonlinear process, so that medicinal effect when the mixture of chemical is dynamised is not equivalent to the sum total medicinal effect of dynamised drugs of its components.

Keywords: Memory of medicine content, tunneling effect, nonlinear integrable dynamical systems, Homoeons, homoeo drug.

Ph.104

**An Account of Application of Carbon Nanotubes in Plant Growth
via Rural Development**

Ali Ahmad Ansari*

Dept. of Physics, Kishanganj College of Engineering and Technology, Veriadngi,
Kishanganj, Bihar, India. Pin -855107.

*Correspondence e-mail: aliahmadansari456@gmail.com

Abstract

Due to change in global population demands the revolutionary change in present agricultural system faced by various unprecedented challenges. Recent applications of Carbon Nanotubes (CNTs) led to the revolutionary development in agricultural growth. These advancements are the base for further engineering, science and technology to create unique properties targeted towards specific applications. From the previous time it is found that the various fields such as biotechnology, medicine, education, engineering, and food processing have employed the successful and safe use of Carbon nanomaterials. However, use in agriculture, especially for plant growth is an under explored area in the research community. Preliminary studies show that the potential of CNT nanomaterial in plant growth. This review summaries agricultural application of CNT nanomaterials and the role of these can play in future agricultural products.

Keywords: Nanomaterials; Carbon nanotubes; Biotechnology; Agricultural application etc.

Ph.105

Structural Investigations of HgTe Nanoparticles by using TOP-Te as Te source

Meera Ramachandra Gumaste*¹ and Gururaj Anand Kulkarni²

¹Visveswaraya Technological University-Research Resource Center, Belagavi, India.

²UBDT College of Engineering, Davanagere, India.

*Correspondence e-mail: dixit.meera11@gmail.com

Abstract

Mercury Telluride (HgTe) nanoparticles are synthesized by organo-metallic route using Trioctylphosphine (TOP) - Tellurium (Te) as Tellurium source. Presence of Hg and Te are established by using Energy Dispersive X-ray analyses. HgTe nanoparticles are found to crystallize into cubic and hexagonal structures as recorded by X-ray diffraction pattern with particle size of 44.38 nm and also tetragonal phase for Te is revealed which is attributed to retrograde solubility curve. High Angle Annular Dark Field and SAED images are obtained for 200 nm and 500 nm resolutions. X-ray Photoelectron Spectroscopic tool is used to study orbital state of Hg and Te.

Keywords: HgTe nanoparticles, TOP-Te, Cubic and Hexagonal, Tetragonal Te, SAED and HAADF, XPS.

107TH INDIAN SCIENCE CONGRESS

JANUARY 3-7, 2020

BANGALORE

VI

**LIST OF PAST
SECTIONAL PRESIDENTS**

PAST SECTIONAL PRESIDENTS

PHYSICAL SCIENCES			
		S. S. Kapoor	1994
Vijay Janardhan Fulari	2019	C. K. Majumdar	1993
Manisha Gupta	2018	R. Chidambaram	1992
S. N. Tewari	2017	S. N. Thakur	1991
Jagdish Rai	2016	M. I. Savadatti	1990
V. P. Mahadevan Pillai	2015	D. K. Rai	1989
Sanjeev R. Inamdar	2014	S. P. Khare	1988
A. K. Rai	2013	V. S. Nanda	1987
B. N. Jagtap	2012	P. S. Narayanan	1986
V. K. Rastogi	2011	Vachaspati	1985
S. H. Behere	2010	G. P. Srivastava	1984
S. P. Ojha	2009	Krishnaji	1983
Lalan Jha	2008	C. Ramasatry	1982
R. N. Singh	2007	B. V. Sreekantan	1981
V. K. Farkya Gupta	2006	C. Mande	1980
R. S. Sirohi	2005	Harnam Singh Hans	1979
Kehar Singh	2004	B. Ramchandra Rao	1978
R. P. Singh	2003	M. K. VanuBappu	1977
		R. P. Singh	1976
	PHYSICS	N. A. Narsimham	1975
R. Nath	2002	L. S. Kothari	1974
S. B. Rai	2001	P. K. Iyengar	1973
J. P. Shukla	2000	A. P. Mitra	1972
T. N. Misra	1999	V. G. Bhide	1971
G. D. Baruha	1998	N. K. Saha	1970
K. P. R, Nair	1997	B. V. Thosar	1969
A. N. Singh	1996	A. R. Verma	1968
Ran B. Singh	1995		

107th Indian Science Congress, Bangalore 2020
List of Past Sectional Presidents

F. C. Auluck	1967	MATHEMATICS AND PHYSICS	
W. M. Vaidya	1966	K. P. Ramanathan	1939
G. N. Ramachandran	1965-64	C. W. B. Normand	1938
R. Ramanna	1963	S. Datta	1937
Vikram A. Sarabhai	1962	T. Royds	1936
S. R. Khastgir	1961	N. R. Sen	1935
S. Parthsarthy	1960	S. K. Mitra	1934
A. K. Dutta	1959	A. L. Narayan	1933
S. L. Malukar	1958	Ganesh Prasad	1932
K. P. Dixit	1957	C. W. B. Normand	1931
B. Peters	1956	B. Venktesachar	1930
R. K. Asundi	1955	S. N. Bose	1929
P. S. Gill	1954	J.de GraffHunter	1928
N. R. Tawde	1953	D. M. Bose	1927
S. Ramchandra Rao	1952	Meghnand Shah	1926
C. S. Venkateswaram	1951	E. P. Metcalfe	1925
R. N. Ghosh	1950	C. V. Raman	1924-23
R. S. Krishnan	1949	T. P. B. Shastri	1922
L. A. Ramdas	1948	J. M. Field	1921
K. Banerjee	1947	N. A. F. Moos	1920
S. Bhagavantam	1946	D. N. Malik	1919
R. C. Majumdar	1945	Wali Mohammad	1918
D. S. Kothari	1944	Rev. D. Mackichan	1917
H. J. Bhabha	1943	PHYSICS	
R. K. Asundi	1942	G. C. Simpson	1916
P. N. Ghosh	1941	C. V. Raman	1915
K. S. Krishnan	1940	V. H. Jackson	1914