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THIRUVANANTHAPURAM

Indian Institute of Science Education and Research Thiruvananthapuram

ANNUAL REPORT
2020-2021

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DIRECTOR'S FOREWORD

J. N. Moorthy
Director,
IISER TVM

This is my second year as the Director of IISER TVM, and I am happy to present the Annual Report for the year 2020-21. The report includes information on all our research and development activities, academic programs and our audited financial statement. The years 2020 and 2021 will go down in the history for most turbulent period with colos- sal suffering and affliction the world has witnessed in more than a century. The COVID 19 pandemic restrictions precluded our effective functioning, severely limiting social interactions, disrupting professional collaborations and wreaking havoc in the region around in particular. Notwithstanding the distressing times, I must say that IISER TVM was largely insulated from the rage of the corona virus. The COVID Response Team (CRT) of IISER TVM has done a commendable job of keeping our campus safe all through the pandemic. This has been possible primarily because of the painstaking and tireless efforts of the CRT team, which has continued to remain alert to any instance of suspicious/- confirmed Covid contraction, immediately initiating isolation, contact tracing, testing and enforcing appropriate quarantine measures. While ensuring the safety of the campus community, IISER TVM has provided unstinting support to the State government in its efforts to contain the spread of the corona virus and keeping the local communi- ties safe. IISER TVM has been testing, having set up a state-of-the-art COVID Testing facility in the institute, hundreds of samples every day.

It would be wrong to say that our academic activities have progressed unhindered through these unprecedented times. Our capacity for innovation and crisis management have never been tested on this scale in the last 13 years. The institute gradually progressed from doing everything on campus to doing everything remotely, which includes admis- sions, online-instruction, examinations, doctoral thesis defenses, conferences and seminars, etc. The roadblocks for transitioning rapidly from classroom teaching to online-engagement with students were a serious challenge, but our faculty, students and staff embraced the change and adapted to the demands of changing times swiftly. Four new and high-tech video-recording studios were set up in the quickest possible time for delivery of high-quality video-recorded teaching material to the students. It is disheartening that the extracurricular activities of the Institute like ITSAV, IISM, ISHYA, IICM, etc. could not be held.

On the academic front, IISER TVM expanded the scope of its programs this year by launching 5 new Integrated and Interdisciplinary BS-MS programs, namely ***i² Sciences.*** These programs are unique in the sense that the curricula are so structured as to ensure 70% of the core content in a chosen discipline that is generally taught as a requirement for MSc in any university, while enabling a high level of interdisciplinarity to the students to specialize in a particular theme of their interest in science and mathematics streams.

In its first year of commencement, the courses for i ^{2} Biological Sciences, i ^{2} Chemical Sciences, i ^{2} Data Science, i ^{2} Mathe- matical Sciences and i ^{2} Physical Sciences have been conducted at full student strength. The campus today has 1413 registered students, of which 1028 are BS-MS students, 152 are I-PhD students and 233 are PhD scholars. Four of our students were selected for the prestigious PMRF this year. I must make mention of some notable accolades to the students –two students from the School of Biology won AWSAR-DST award and EMBO short-term fellowship, offered by the University of Bristol. One student in the School of Physics won the IEEE Magnetics Society award.

Despite the fact that the faculty strength I IISER TVM is relatively smaller (73 overall – 11 Professors, 21 Associate Profes- sors and 41 Assistant Professors), the faculty has been engaged in diverse frontier areas of research. In the year 2020-2021, the number of publications in reputed journals was over 200. I take pride to inform that four of our faculty from the School of Physics, two from the School of Biology and one from the School of Chemistry secured research grants of excess of 1 crore to several crores from the DST, DBT and SERB for their research on quantum systems, quantum computing, electrophysio- logical homeostasis and vaccines for emerging SARS.

It is a matter of great honor for our Institute that every year our faculty receive prestigious national and international awards. This year too, our faculty have been awarded the A V Rama Rao Foundation Prize, the Bronze medal of the Chemical Research Society of India (CRSI), National Award in Technology Innovation, etc. Our faculty continue to be invited to be on the editorial boards of leading scientific journals, executive committee/board members of important scientific bodies, etc. It's needless to mention that several faculty members pursue collaborations with reputed national and international researchers actively in emerging areas of science.

Inspite of the restrictions imposed by the pandemic, we have assiduously remained connected with our students and collabo- rators through virtual seminars and conferences, sharing research findings and plans for future projects. Across Schools, we have hosted 44 invited talks by national and international experts, conducted 2 workshops and hosted the VAIBHAV Summit that brought together more than a 100 national experts and international experts with Indian roots to collaborate on frontier areas of research.

The Student Affairs Council (SAC) conducted a number of online events as part of Anvesha 2020 – the Science Fest of the Institute. The events included Inquisitio 1 & 2, Crime Scene Investigation, Resenseo, Code Battle, Science in Canvas and the Nobel Lecture Series; the latter had participation of students/researchers from colleges and institutes spread across the country. The monthly science newsletter from the Science and Technology Council is published online without any disruption right through the pandemic, and it is now accessed by external subscribers as well.

We are establishing a Specific Pathogen-Free (SPF) Laboratory and Animal Facility in our campus which will augment the Life Sciences research in Kerala. IISER TVM entered into an MoU with the KSIDC, the prime industrial development and investment promotion agency of the Government of Kerala, to provide companies that are beginning operations in the Life Science Park at Thonnakkal with animals for conducting their research. The agreement also provides for utilization of research facilities available at the Institute and a provision for availing consultancy services from scientists of the Institute.

Despite the challenges, we have been making a gradual progress in training students, increasing faculty strength, launching new programs, expanding the campus infrastructure and nudging the constructions to completion to push the institute toward exiting the project mode. I hope that this Annual report succinctly provides all details of IISER TVM's academic pursuits, research priorities and accomplishments and future directions.

J. N. Moorthy
Director

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RESEARCH REPORTS

SCHOOL OF CHEMISTRY

ORGANIC CHEMISTRY

Prof. J. N. Moorthy

Professor & Director

In continuation of our on-going activities focusing on *de novo* development of porous functional materials, we have developed bis(*p*-carboxyphenyl)imidazolylarenes as a unique class or organic linkers for construction of porous materials, Figure 1. Using these systems, we have begun to develop porous materials for sensing applications. We have recently shown that systems based on anthracene and 1,4- dimenthoxybenzene core can be exploited to develop 2-dimensional metal-organic nanosheets (2D MONs), which permit selective sensing of nerve agent mimics (*ACS Appl Nano Mater*. 2021, 04, 449) and anions such dihydrogen phosphate, i.e., H2PO4 (Submitted). In a related study we have shown that MOFs constructed from conformationally-flexible 2,7-bis(3,5-dicarboxyphenyl)-9,9′-diphenyl-9H-fluorene linker permit mechanoluminescence and aggregation-enhanced emission (AEE), see: *Nanoscale*, 2021, 13, 9668.

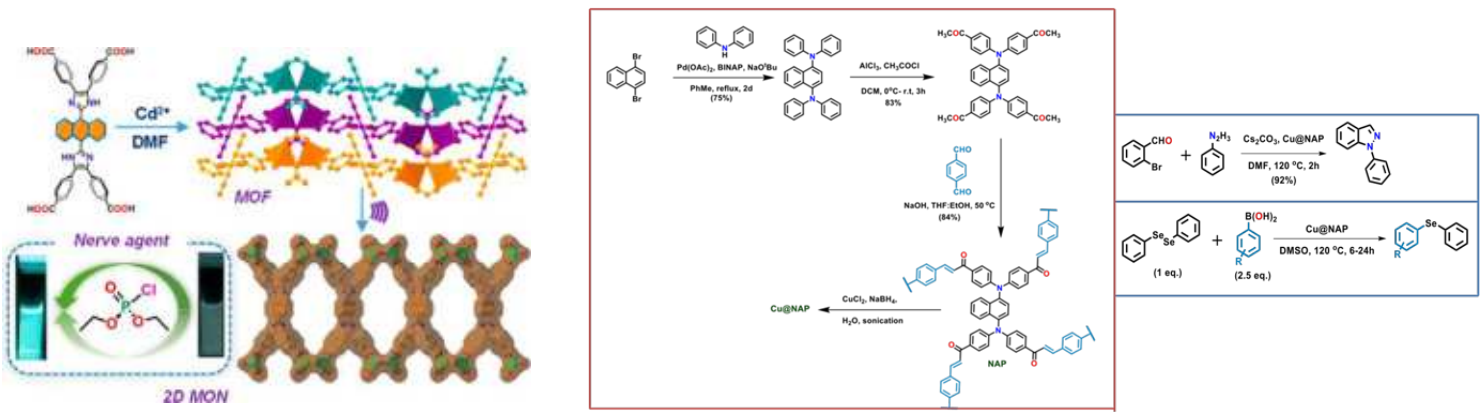


Figure: Left: Bottom-up access to 2D metal-organic nanosheets (MONs). Right: Immobilization of metal nanoparticles and application to synthesis in recyclable catalysts.

Covalent polymerization of contrived molecular building blocks leads to porous organic polymers (POPs) with intrinsic microporosity. Although a variety of reactions have been exploited for creation of innumerable porous organic polymers (POPs), Aldol condensation reactions between aldehydes and ketones leading to enones remain unutilized quite inexplicably. By subjecting rationally designed tri/tetraacetyl-functionalized aryl amines to aldol condensations with terephthalaldehyde, different POPs that feature enone functionalities have been synthesized and shown to exhibit palpable gas sorption properties. Indeed, they are found to stabilize in situ-generated metal nanoparticles to enable application of the resultant materials as recyclable heterogeneous catalysts for a number of organic transformations. In our recent studies, we have shown that Cu nanoparticles stabilized by the POPs (Figure 1) can be exploited for the synthesis of isoindazoles and diarylselenides conveniently (Unpublished results).

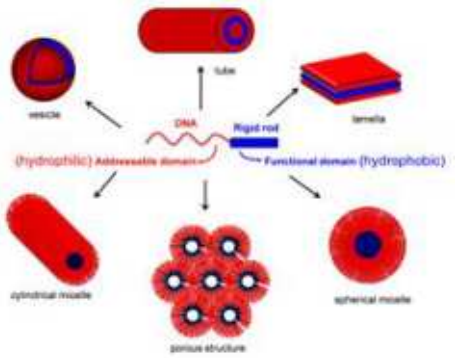
Prof. Kana M. Sureshan

Professor

An important area of research in Sureshan group is the design of topochemical reactions. Topochemical reactions, the reaction between pre-organized reacting motifs in the crystal lattice, are attractive as they do not require solvents, catalysts and other special reaction conditions for the reaction and provide products in pure form. We have developed thermal Topochemical Azide–Alkyne Cycloaddition (TAAC) reaction to synthesize various biopolymer mimics. We have exploited hydrogen bonding for the self-assembly of monomers in solid or gel to pre-organize the reacting motifs. Lattice controlled polymerization/oligomerization reaction of such pre-organized monomers gave various biopolymer mimics.By applying this methodology, we have topochemically synthesized glycopolymers, oligosaccharide mimics,DNA analogs and polypeptides. Many other topochemical reactions are being designed and pursued in our lab, to make functional materials. Design of novel gelators and their application in novel areas is another research topic in our group. We are also interested to develop novel organic transformation strategies,chemo/regioselective reactions, development of catalysts for novel transformations etc. We have devised a novel general strategy for inversion of up to three contiguous stereocenters. We demonstrated the efficiency and generality of this strategy by the practical synthesis of unnatural/rare carbohydrates and cyclitols from the cheaply available isomers. An important class of natural polyols is the carbasugars having c7 cyclitol skeleton. They have the common cyclohexenyl skeleton with a one-carbon side chain. We have developed a general methodology to install the internal double bond and the one-carbon side chain in cyclitols through a vinylogous opening of the orthoester or ketal. We have used this methodology to synthesize several natural carbasugars.

Dr. Reji Varghese

Associate Professor

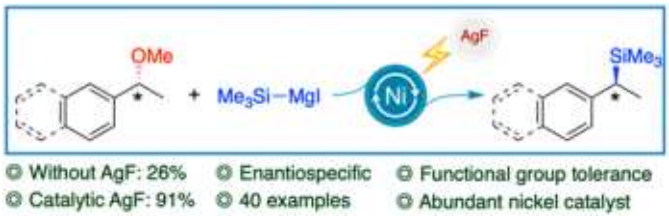


Supramolecular chemistry with DNA

Dr. Reji Varghese's group is interested in the design and synthesis of DNA decorated nanostructures for various biological applications. Over the past few years, this group has developed a class of amphiphiles known as DNA-based amphiphiles. The unique structural feature of the nanostructures obtained from the self-assembly of DNA amphiphile is the extremely dense decoration of the surface with ssDNS of defined sequence (Acc. Chem. Res. 2020, 53, 11, 2668). Accordingly, this kind of nanostructures act as a nanoscaffold for the defined organization of other functional molecules of interest. The organization of plasmonic nanomaterials into various 1D, 2D and 3D nanostructures with interesting optical properties have shown. Moreover, the protrusion of ssDNA of defined sequence was used for the integration of cell targeting moieties for targeted drug delivery. Current interest of the group is to study the self-assembly of DNA amphiphile in a specific cell compartment by exploring the peculiar behaviors of cancer cell compared to normal cells for the development of drug-free cancer therapy.

Dr. Ramesh Rasappan

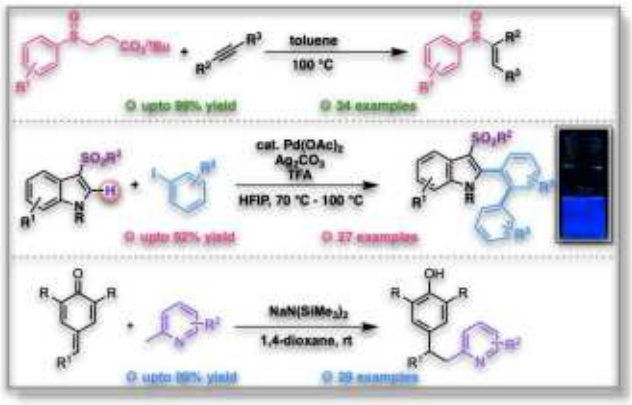
Assistant Professor Grade I



The construction of C-C bond is a fundamental process in pharmaceutical industries. The group of Dr. Ramesh Rasappan focus on nickel mediated cross-coupling reactions to forge C-C bond. Subsequently, the new methodology gets extended to the synthesis of bioactive molecules. Recently, the group established an acylation reaction (10.1021/acs.orglett.0c00554) via C-N bond cleavage and was highlighted in synfacts and organic chemistry portal.The group also developed asymmetric cross-coupling reactions, enantiopure chiral silanes were synthesized by utilizing this methodology. Very recently, the group took advantage of modern C-H activation and photocatalysis: A dual catalytic nickel and photoredox catalysis was developed. A large library alkyl aldehydes were coupled with alkyl pyridinium salts via acyl radical generation. An expensive tungstate catalyst was employed for the selective C-H activation.

Dr. Alagiri Kaliyamoorthy

Assistant Professor Grade I



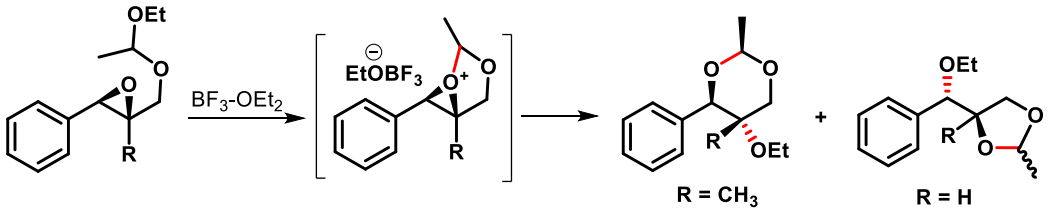
Dr. Alagiri's group research interests are directed towards organic synthesis with the focus on developing new synthetic strategies, asymmetric catalysis, and total synthesis of complex natural products having biological significance. Currently, his group primarily works on the activation of less reactive pronucleophiles to active nucleophiles in the presence of a binary catalytic system, which consists of a soft Lewis acid, Lewis base, and Brønsted base followed by nucleophilic addition to electrophiles. In this direction, his group accomplished a 1,6-conjugate addition of alkylazaarenes to various para-quinone methodes. Additionally, his group works on transition metal-catalyzed C–H functionalization of various aromatic and heteroaromatic precursors. Along these lines, his group developed a palladium-catalyzed direct C2-biarylation of indoles, and the consequent products were found to show interesting UV/visible absorption and fluorescence properties. The other area of his group research interest is developing various C–C and C–X bond forming strategies and developed a synthetic route for the synthesis of various alkenyl sulfoxides from terminal alkynes and β-sulfinyl esters via thermolysis of β-sulfinyl esters.

Dr. Rajendar Goreti

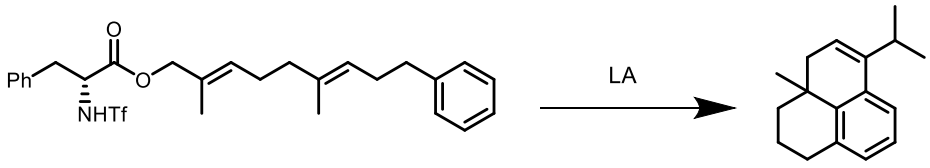
Assistant Professor Grade I

Sharpless epoxides are versatile synthons and viable electrophilic species; their ring-opening with various nucleophiles received tremendous attention in the synthetic community for their application in total syntheses of several complex natural products. Because of the high energy lone pair and huge ring strain in epoxide, an electrophile selectively activates the epoxide in the presence of other nucleophilic groups such as alcohols, esters, carbonates, carbamates, etc. present within the molecule.

We showed that an acetal group selectively gets activated in the presence of epoxide to produce an oxocarbenium ion which act as an internal electrophile to initiate epoxide ring-opening to produce a bicycloepoxonium ion. The bicyclic epoxonium ion then undergo nucleophilic addition either in *exo*- or *endo*-fashion to provide fully protected triols. To the best of our knowledge acetals of epoxy alcohols had never been prepared for the exploration in epoxide cyclization reactions. These epoxide-opening cyclizations are highly stereoselective, and the regioselectivity was completely controlled by the substrate structural features.



A Lewis acid activated Bronstead acid initiated double annulations of homogeranyl esters produced phenalene derivatives. These phenalene derivatives have similar carbon skeletons to psuedopteroxazoles (anti-tuberculasis compounds). *N*-triflimide amino acid was used as an auxiliary and the N-H group as internal Bronsted acid to protonate more nucleophilic double bonds to initiate carbocyclization. The allylic ester further undergo heterolytic cleavage followed by Friedel-Craft alkylation to produce fused tricyclic carbo cycles.

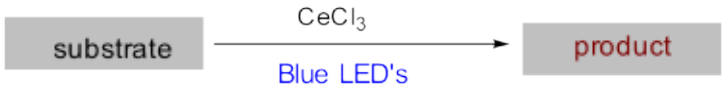


We developed a new method for the enhanced *E*-selectivity in Julia-Kocienski reaction using weakly coordinating quaternary ammonium ions. Because of chelation the alpha-alkoxy/amino aldehydes provide poor *E*/*Z*-selectivities in Julia-Kocienski reaction. A systematic investigation of chelation effect on *E*/*Z*- selectivity was carried out with different alpha-alkoxy/amino aldehydes. We found that the use of bulky non- coordinating quaternary ammonium salts enhanced the *E*-selectivity of olefin formation. The method was developed during the total synthesis of rickiols.

Dr. Veera Reddy Yatham

Assistant Professor Grade I

Our group focuses on development of new synthetic methodologies in the fields of photoredox catalysis and their applications in the late-stage functionalization of drugs and drug-like molecules. Their main focus is on utilization of feedstock chemicals as reactants and employing inexpensive chemicals as photocatalysts. In this direction they found that the utilization of inexpensive chemicals such as CeCl3 for the chemo selective conversion of benzylic alcohols to aldehydes without formation of benzoic acids. Also, interestingly they found that CeCl3 effectively catalyzed the radical smiles rearrangement of 2-Aryloxybenzoic acids under visible light. Furthermore, they have applied their methodology for the gram scale synthesis of Guacetisal an important drug molecule in the pharmaceutical industry.

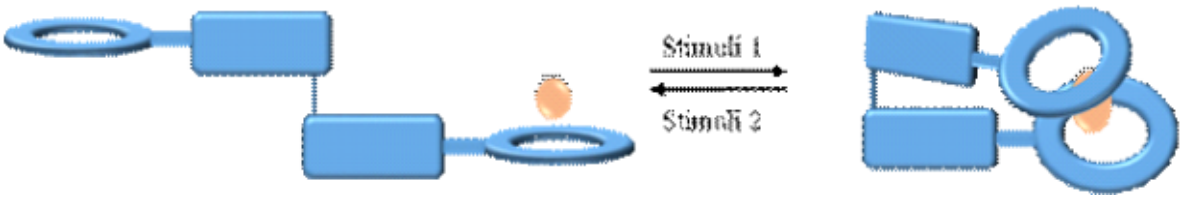


Dr Soumen De

Assistant Professor Grade I

Our research is primary focused on the inter-disciplinary field of dynamic complex supra-molecular architectures to regulate the structure and motion across all scales to create new materials, discover their emergent properties and perform useful tasks through modulating different supra-molecular interactions. In doing so, we would like to expose important features of dynamic systems in biology and develop know-how in the design that will be critical in realizing the potential of supramolecular systems. To control the dynamic properties of our systems, we are interested to explore new switchable architectures. In our research, we apply methods from synthetic organic chemistry to create our building blocks and use different non-covalent interaction and dynamic covalent chemistry to decorate the suitable functional groups in the desired position. Thus, it will help in expanding the tool-box available for practitioners in the field of supramolecular chemistry to control the structures and motions at various scales. Our research includes: Molecular switches and machines; Abiotic foldamers and their host-guest properties; Stimuli-responsive dynamic materials.

Funding: Start-up research grant from our institute and from SERB



Scheme 1: Cartoon representation of stimuli induced switching between two states.

Dr. Basudev Sahoo

Assistant Professor Grade I

Sustainable Organic Synthesis & Catalysis:
Sustainability is an aspect that has emerged to be widely considered in modern organic synthesis. Despite the chemical inertness, the utilization of renewable and easily available feedstocks have captured the broader attentions of synthetic organic chemistry community, while developing synthetic strategy for the constructing value-added products. Our research investigations encompass the following topics:

(a) **Transition Metal catalysis:** In this research area, we intend to explore the novel reactivity of transition metal-based catalysts through its rational design, mechanistic probing and practical applications. The utilization of earth abundant metals holds the immense interests in organic synthesis while developing novel synthetic methods for molecular architecture construction from-feedstocks. Mechanistic rationale will be addressed through spectroscopic techniques for the betterment of catalysts and methods.

(b) **Photocatalysis:** Visible Light Photocatalysis has emerged to be a mild catalytic technique to activate the inert substrate for forging molecular linkages. We will develop the synthetic strategy for selective functionalization of inert bonds as well as less reactive functionality for late-stage modifications of natural products, pharmaceuticals and so on.

(c) **Metal Free Coupling Reactions:** As an alternative to the transition metal catalysis paradigm, metal-free approach has well been accepted in synthetic organic chemistry, where we would like to contribute in the coupling chemistry arena, promoted by Phosphorus, Sulfur or Boron-based catalyst/reagent, dealing with the molecular entities that find difficulty in transition-metal catalysis.

INORGANIC CHEMISTRY

Dr. Ajay Venugopal

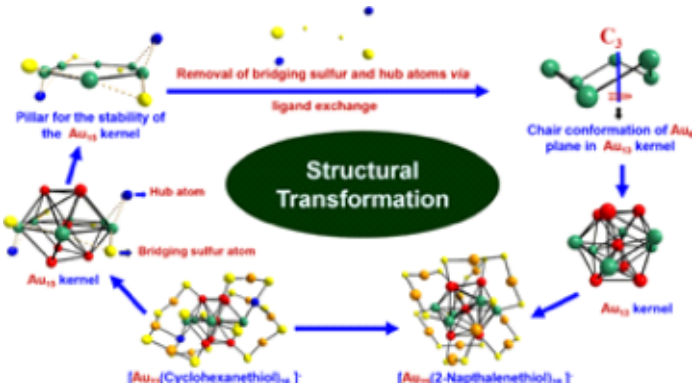
Associate Professor

Zinc has been an element of choice for carbon dioxide reduction in recent years. Zinc compounds have been showcased as catalysts for carbon dioxide hydrosilylation and hydroboration. The extent of carbon dioxide reduction can depend on various factors, including electrophilicity at the zinc centre and the denticity of the ancillary ligands. In a few cases, the addition of Lewis acids to zinc hydride catalysts markedly influences CO_2 reduction. We have investigated these factors by exploring elementary reactions of CO_2 hydrosilylation and hydroboration using cationic zinc hydrides bearing the tetradentate tris[2-(dimethylamino)ethyl]amine and the tridentate N,N,N′,N″,N″-pentamethyldiethylenetriamine in the presence of triphenylborane and tris(pentafluorophenyl)borane. The five-coordinate $[(Me_6tren)ZnH]+$ alone shows moderate reactivity towardsCO_2 hydrosilylation. While decreased ligand denticity is expected to exhibit higher reactivity, the four-coordinate [(PMDTA)ZnH]+ alone did not catalyze this process. This has been attributed to the formation of a stable zinc formate dimer. The mild Lewis acid, BPh_3 was employed as an additive to generate the monomeric zinc formate to facilitate hydrosilylation. $B(C_6F_5)_3$ can be an attractive choice as a strong Lewis acid additive. We observed that it arrests the catalytic cycle by forming a stable [HB(C6F5)3]- anion. The use of the hydroboration reagent, H-Bpin, further strengthened our proposition on the secondary Lewis acid's role in cationic zinc hydride mediated CO_2 reduction. Our findings validate cationic zinc centers' role in activating Si-H and B-H bonds and reveal the importance of the second Lewis acidic center for facile catalytic CO_2 reduction.

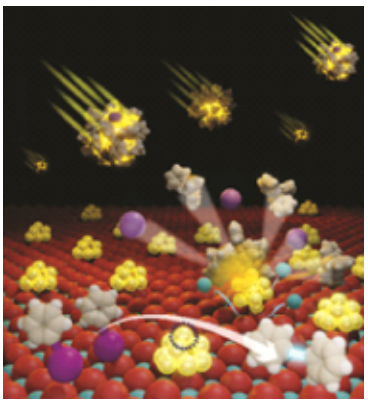
Dr. Sukhendu Mandal

Associate Professor

Dr. Sukhendu Mandal's group focused on synthesizing new materials with useful and interesting properties as well as applications. We are currently focused on synthesizing atom-precise metal nanoclusters as well as metal-organic frameworks (MOFs). The nanocluster (NC) sub-group has been involved in both synthesis of application-based Au and Ag-based NC as well as study of the fundamental nature of nanocluster structure transformation. Recently, we reported a mechanistic study of the effect of the nature of ligand in the transformation of NC from one geometrical kernel to another (J. Phys. Chem. Lett, 2020, 11, 10052-10059, Fig. 1a). Currently, work has been going on to develop Ag-based cluster-assembled materials and studying their properties. Catalytic activity of Au-phosphine based cluster on being embedded in metal oxide defect had been reported by our group recently (ACS Nano, 2020, 14, 16681-16688, Fig. 1b). Studies are underway to study the catalytic behavior of Au-NC on being embedded in defect site of MoS2.



(a)



(b)

Figure: (a) Study of mechanism of nanocluster transformation; (b) schematic representation Au11@CeO2 for catalytic C-C bond coupling.

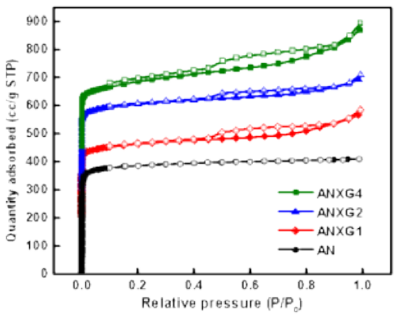
Several MOFs have been reported by our lab that have been used for catalysis, oxygen reduction reaction and conductivity. Most recently the group has been working on metal nanoparticle incorporation in defect-engineered MOF and studying its catalytic behavior. Another work involves the study of charge-transfer mechanism of conductive MOF which is made of redox-active ligands

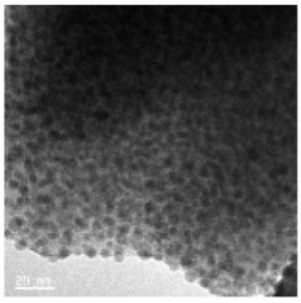
Dr A. Thirumurugan

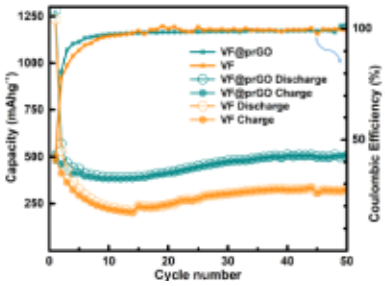
Assistant Professor Grade I

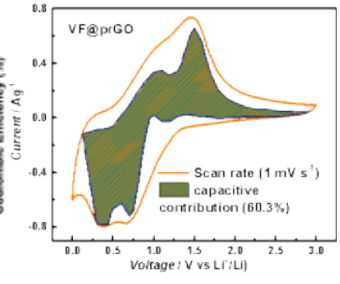
Materials for Energy Applications

Dr. A. Thirumurugan's research group explores new and novel materials for energy and sustainable development. In particular, the focus is on the investigations of coordination polymers, metal organic frameworks, nanocellulose composites of porous materials, vanadium oxide clusters and their nanocomposites for molecular (gas) storage - separation, optical and electrochemical energy storage properties. We have employed soft template based mesoassemblies of gemini surfactants to introduce mesopores in one of the well-known (MOFs), such as HKUST-1 and UiO-66. By inducing variations in the nucleation and crystal growth conditions that are crucial to achieve a wide range of hierarchical porosity (HP). Such HP materials are used in small molecular gas and dye separation processes. Mixed matrix membranes of MOF-nanocellulose composites @ cellulose acetate, have been explored for CO2, alkane, N2 gas separation applications. Materials that provide simultaneously optimal energy density and power density for the next generation electrochemical energy storage (EcES) devices is an important research focus. We have explored vanadium based materials, a layered vanadium formate (VF) coordination polymer and another Vanadium oxide cluster along with their composites of partially reduced graphene oxide (prGO), as anode materials for the Li-ion based EcES systems in the potential range of 0-3 V (vs Li+/Li). Our studies reveal that a reversible capacity in the range of 300-400 mAhg-1 at a current density of 50 mAg-1 after 50 cycles can be realized along with a high rate capability and a good capacity retention. The composite exhibits even a higher capacity. An ex-situ X-ray photoelectron spectroscopy (XPS) study indicates the involvement of V3+/V4+ or V4+/V5+ redox couples in the charge storage mechanism. A significant contribution of this reversible capacity is attributed to the pseudocapacitive behavior of the system. In the graphene composites, an enhanced electrochemical performance is observed with an enhanced energy density and a power density. Presence of the conductive interfaces could be the reason for the observed enhancement in the overall EcES performance.









Dr. Gokulnath Sabapathi

Assistant Professor Grade I

Dr. Gokulnath's group is developing new methods to accomplish various functional macrocycles with altered optical and coordination properties. NH tautomerism plays a vital role in developing molecular switches and information storage. In porphyrinoids, NH-tautomerism can be distinguishable and exhibit two different optical properties when porphyrin possesses irregular substitution leading to unsymmetrical structures on the cores. Such NH tautomerism in porphyrins occurs via stepwise through cis-intermediate supported by tunnelling mechanism in solution. The unequal ground and excited state energies in metal-free porphyrins resulting in dual emission involving NH-tautomerism. Dual emitters (DEs) have gained immense attention recently due to their potential applications in various fields such as sensors, multicolour display, white organic light emitting diodes (WOLEDs), data encryption and bio-imaging. Due to the close relation between NH-tautomerism and dual emission in various macrocyclic compounds, Dr. Gokulnath's group devised a meso-modification strategy on the carbazole embedded porphyrin with a meso-pyrrole substituent. Such substitution provides nonsymmetric structures that can lead to two distinguishable pathways for the tautomeric process. Hence, efforts have been made to study whether the tautomerism can takes place either via step-wise or simultaneous double intramolecular hydrogen transfer (DIHT). DIHT can be achieved via thermal activation or by a photo-induced process in which the meta-stable cis intermediates facilitate such DIHT. Other possible tautomeric species involving single or double proton transfer are identified, but were found to be energetically high making the tautomerism unfavorable, as calculated by DFT. Single-crystal X-ray diffraction analyses reveal planar conformation of the macrocycles, whereas slight distortion of macrocyclic plane with two strong intermolecular N-H···N hydrogen bonding interactions were observed in meso-pyrrolyl substituted macrocycle. The combined photophysical and theoretical studies confirms a dual emission originating from two tautomers 3T1 and 3T2 having lower symmetry. Further work is ongoing to establish the underlying mechanisms associated with NH tautomerism and structure of the molecule in the excited state.

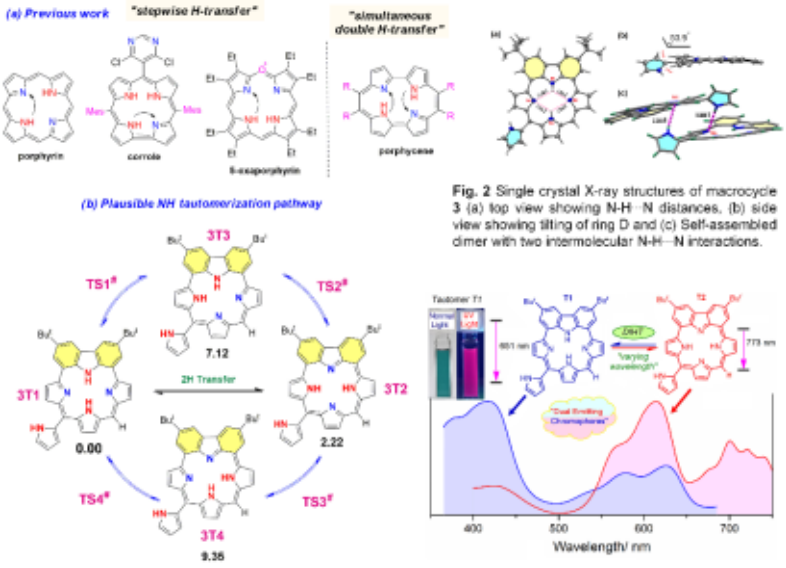


Fig. 2 Single crystal X-ray structures of macrocycle **3** (a) top view showing N-H···N distances, (b) side view showing tilting of ring D and (c) Self-assembled dimer with two intermolecular N-H···N interactions.

Fig. 1 (a): Selected examples of dual emitters (b) Plausible pathway for NH-tautomerization between **3T1** and **3T2**. The relative energies for each tautomers are given at the respective chemical structures (unit: kcal mol^{-1}).

Dr. Subrata Kundu

Assistant Professor Grade I

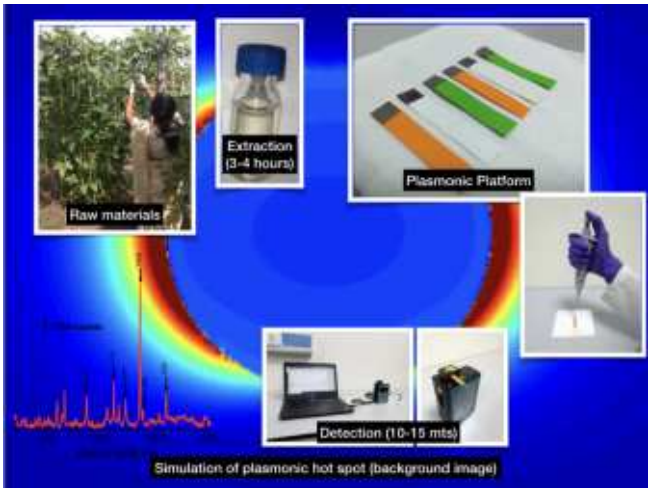
The Bioinorganic Research Group guided by Dr. Subrata Kundu is actively engaged in providing molecular level insights into the signalling routes of hydrogen sulfide (H2S) and nitric oxide (NO) in mammalian physiology. While H2S and NO are historically known as notorious toxins, both the gaseous molecules have recently attracted extensive research interests because of their pivotal roles as gasotransmitters in a diverse array of physiological processes including vasodilation, immune response, and neurotransmission. Consequently, the generation and utilization of H2S and NO in the biological milieu are very tightly regulated through complex chemical pathways. Notably, therapeutic opportunities of H2S and NO donors are often uncertain due to the lack of unambiguous molecular level insights into these biochemical routes. In these connections, Dr. Subrata Kundu's research group focuses on providing insights into the reactivity profiles of ubiquitous nitrogen-oxyanions. Although the activations of NOx– anions to ammonia are commonly mediated by transition metal sites either electrochemically or enzymatically, our recent report reveals proton-assisted transformations of NOx– anions in the presence of electron-rich methoxy-aromatic compounds such as 1,3,5-trimethoxybenzene (TMB-H) affording a rare set of mostly elusive diaryl oxoammonium species [Ar2NO]+. Subsequently, a water promoted decomposition of diaryl oxoammonium species [TMB2NO]+ leads to the generation of ammonia, thereby connecting two extreme oxidation states of N, specifically N+V in NO3– anion and N–III in NH3.

On the other hand, our research group is also engaged in disclosing electrophilic activations of sulfane-sulfur species such as elemental sulfur and organic polysulfides. Most importantly, this ongoing study sheds light on assimilation of elemental S, interconversion of sulfane-sulfur species under biologically relevant conditions.

PHYSICAL CHEMISTRY

Prof. K. George Thomas

Professor



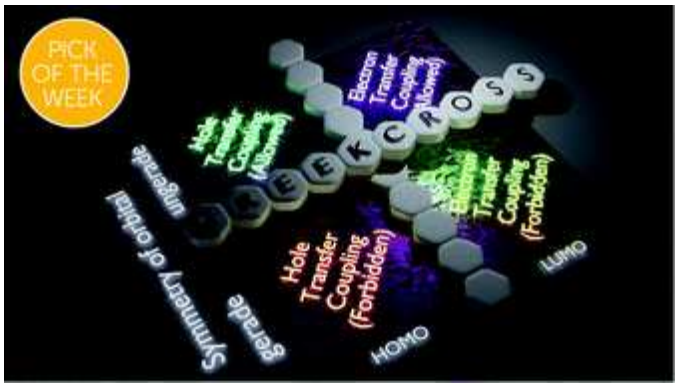
A sandwich SERS platform based on assembled plasmonic nanoparticles on metal film is designed by functionalizing thin silica-coated (t ~3 nm) metal (Ag/Au) nanoparticles of ~50 nm diameter onto Au films having varying thicknesses (~20 nm and ~60 nm). Based on the investigations, it is concluded that the quality (Q) factor of the plasmonic nanoparticle plays a significant role in interplasmon coupling between film and Au/Ag nanoparticles. This is evident from the enhanced Raman signal intensities observed for the analyte on Ag@SiO2 assemblies on Au film of 20 nm thickness as compared to that of Au@SiO2 assemblies under identical conditions, which is attributed to the high Q-factor of Ag nanoparticles over Au nanoparticles. Based on the experimental studies from our group and theoretical investigations by Dr. R. S. Swathi's group, we conclude that the thickness of the underlying metal film also plays a significant role in Raman signal enhancement. Regions of intense electric field and large Raman enhancement factors are observed upon increasing the thickness of the Au film (~60 nm) underneath the Ag@SiO2 assembled structures, permitting an effective interplasmon coupling.

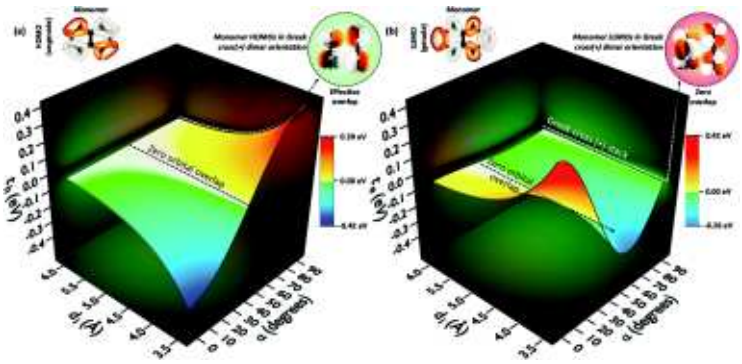
We have developed a surface-enhanced Raman spectroscopic device for the rapid analysis of of pesticide/insecticide residues in fruit and vegetables. This work is carried jointly with Prof. Anil Shaji of the School of Physics, Dr. K. R. Arun and Dr. Dharmatti Sheetal of the School of Mathematics and Dr. R. S. Swathi from the School of Chemistry, funded by the IMPRINT project of Ministry of Education and Department of Science and Technology, Government of India, at IISER Thiruvananthapuram and Kerala Agricultural University. The cost-effective extraction of pesticide residues from fruits/vegetables using graphitized carbon black has been developed by Kerala Agricultural University (our collaborating partner in the IMPRINT project). Paper based plasmonic substrates using silver core-shell nanoparticles that can sensitively detect both hydrophobic and hydrophilic molecules were fabricated. These platforms were integrated with a hand-held Raman spectrometer (purchased) as well as bench-top Raman spectrometer (assembled with the assistance of Prof. Chandrabhas Narayana, RGCB, Trivandrum). The in-house software has been interfaced with the device for data analysis (using three different data processing algorithms developed at IISER TVM) allows the pesticide detection up to parts per billion (ppb) level in 3-4 hours. The device provides a PASS/-FAIL output depending on the total pesticide/insecticide content. This method can provide fast on-site detection of pesticide contamination at various stages of production, transportation and marketing of fruits and vegetables.

Prof. Mahesh Hariharan

Professor

The topology of frontier molecular orbitals (FMOs) induces highly sensitive charge transfer coupling with variation in the intermolecular arrangement. A consistent optoelectronic property correlated to a specific aggregate architecture independent of the nature of the monomer is a rare phenomenon. Our theoretical investigation on stacked dimeric systems of linear [n]acenes (n = 2–5) and selected nonlinear acenes with a D2h point group reveals that the Greek cross (+) stacked orientation, irrespective of the molecular candidate, exhibits mutually exclusive hole and electron transfer couplings. The deactivation of either hole or electron transfer coupling is a consequence of the zero inter-orbital overlap between the highest occupied molecular orbitals (HOMOs) or lowest unoccupied molecular orbitals (LUMOs) of the monomers possessing gerade symmetry. In the Greek cross (+) stacked alignment, the (4n + 2) π-electronic acene systems with an odd number of benzenoids exhibit exclusive electron transfer coupling, while the even numbered acenes exhibit selective hole transfer coupling. The trend is reversed for representative 4n π-electronic acene systems. The effect of mutually exclusive charge transfer coupling in the hopping regime of charge transport was evaluated using semiclassical Marcus theory, and selective charge carrier mobility was exhibited by the Greek cross (+) stacks of the considered acene candidates. Additionally, the characteristic charge transfer coupling of the orthogonal acene stacks resulted in negligible short-range exciton coupling, inciting null exciton splitting at short interplanar distances. Engineering chromophores in precise angular orientations ensuring characteristic emergent properties can have tremendous potential in the rational design of advanced optoelectronic materials.



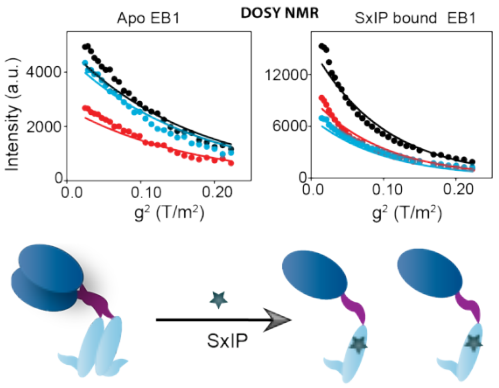


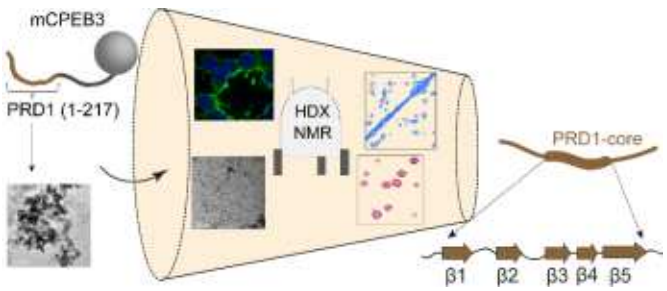
Dr. Vinesh Vijayan

Associate Professor

Our group works on the interface of solid, and solution state. Our lab focuses on developing and using NMR tools to study, and understand the structure, dynamics, and function of biomolecules. Recently we have been trying to understand the SxIP mediated dynamic stability of EB1 protein in solution. EB1 is a plus-end tracking proteins (+TIPs), localize at the plus end of MTs and regulate the MT plus end dynamics, and thus controlling the various microtubule-mediated cellular processes Using NMR as a primary method, we determined that SxIP binding destabilizes EB1 dimer. Further, SxIP binding promoted the folding of the unstructured C-terminal domain of EB1 (I224A) mutant. Additionally, we also discovered that SxIP modulates the backbone dynamic of N-terminal domain of EB1 by reducing the EB1n-EB1n, and EB1n-EB1c transient interactions. The previously unknown outcome of the binding of SxIP with EB1 is thus elucidated which could be significant in elucidating the mechanism of EB1 activation.

Our main focus on recent years were on characterizing the structural transitions in amyloidogenic proteins. We have been making considerable progress in mapping the aggregation of different segments of CPEB3 (cytoplasmic polyadenylation element binding) protein, whose prion character is responsible for the long-term memory in mammals. We report that the first prion sub-domain PRD1 of mouse CPEB3 can autonomously form amyloid fibrils in vitro and punctate-like structures in vivo. A ninety-four amino acid sequence within the PRD1 domain, PRD1-core, displays high propensity towards aggregation and associated amyloid characteristics. PRD1-core is characterized using electron microscopy, X-ray diffraction, and solution-state NMR deuterium exchange experiments. Secondary structure elements deduced from solid-state NMR reveal a β-rich core comprising of forty amino acids at the N-terminus of PRD1-core. The synthesized twenty-three amino acid long peptide containing the longest rigid segment (E124-H145) of the PRD1-core rapidly self-aggregates and forms fibrils, indicating a limited aggregation-prone region that could potentially activate the aggregation of the full-length protein. This study provides the first step in identifying the structural trigger for the CPEB3 aggregation process.

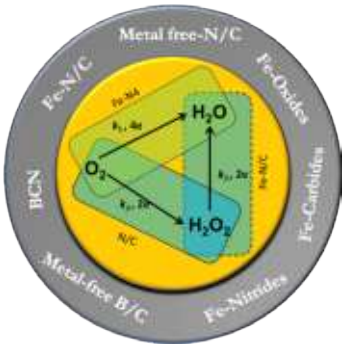




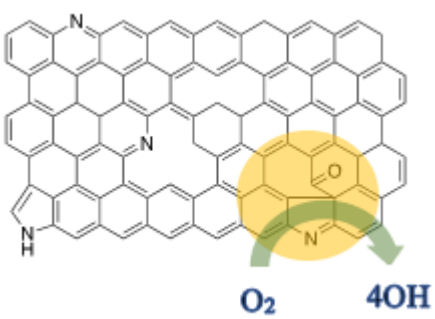
Dr. A Muthukrishnan

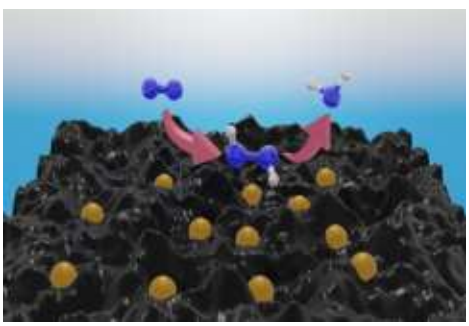
Assistant Professor Grade I

Oxygen reduction reaction (ORR) is one of the most studied reactions in the electrocatalysis. The most abundant element oxygen is used as the oxidizing agent in the low-temperature hydrogen fuel cells. Typically, platinum-based catalysts have been used to improve the ORR kinetics, limiting large-scale commercialization of fuel cells for energy applications. Understanding the ORR mechanism and the active sites information on the NPGM or metal-free catalysts are the real bottlenecks for the development of highly active and durable Pt-free catalysts for the ORR. Despite the series of attempts to characterize the active sites and ORR mechanism, the conclusions are not clear and lead to debate.



Dr. Muthukrishnan's group is working on fundamental aspects of ORR, characterizing the active sites and mechanism of the Fe-N/C and N-doped carbon catalysts, via the kinetic analysis. A bottom-up approach to describe the role of various possible entities present in the heat-treated heteroatom doped Fe-containing catalysts is individually studied. The iron oxide on porous carbon support for its role in ORR was studied. Also, the mechanism of the synergistic effect on the two heteroatom-doped (boron and nitrogen) metal-free carbon catalysts. To specific, the BCN materials are studied, and its kinetic analysis reveals the mechanism of the synergistic effect. The defects on the carbon substrates towards ORR activity are analyzing by specially created defects. The selective edge functionalization of heteroatom-doped graphene was employed to create the topological defects, which significantly improves the ORR activity in alkaline medium. (highlighted in figure)





Dr. Narendra Kurra

Assistant Professor Grade I

The objective of my research group is to design new materials towards development of next generation electrochemical energy storage devices. Specifically, two-dimensional (2D) redox materials are the prime choice due to their unique structure with tunable physicochemical properties. MXenes, a relatively new and large family of 2D transition metal carbides, nitrides, and carbonitrides, have been the front-runners of energy storage materials due to their metallic conductivity combined with redox charge storage properties. Our group would explore on MXene materials as charge hosts for multivalent (Mg+2, Zn+2, Ca+2 and Al+3) metal-ion batteries and hybrid metal ion capacitors. Controlling surface chemistry, engineering of electrode architectures, and understanding MXene|electrolyte interfaces are the key research directions. Fundamental understanding of charge storage dynamics across MXene galleries enable development of high-rate high energy storage devices. Due to initial stages of development and based on the merit of their electrochemical performance, MXene materials may be suitable for developing On-chip energy storage devices. Moreover, the current trend of emerging Internet of Things (IOT) and miniaturization of electronics demand for developing small scale energy storage devices. On-chip and printed MXene devices can offer compatible integration in powering up micro-robotics, micro-sensors and bio-medical implants.

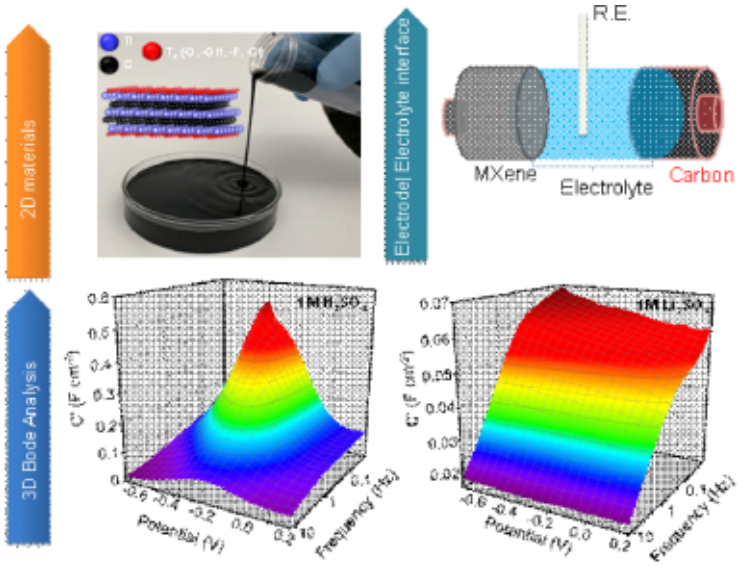


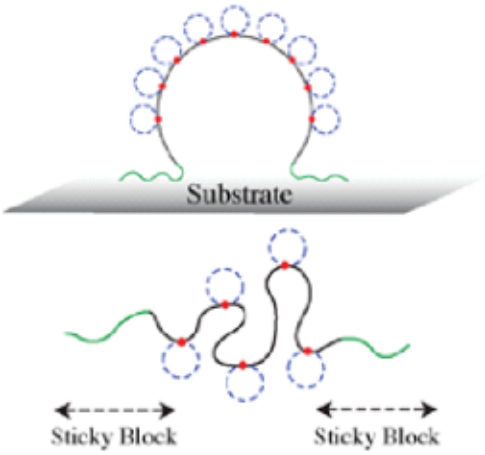
Figure: Synthesis of MXene materials by top-down wet chemical etching. Understanding the charge storage dynamics of MXene|electrolyte interfaces. Development of next generation energy storage devices including but not limited to multivalent metal-ion batteries, hybrid metal-ion capacitors and On-chip energy storage.

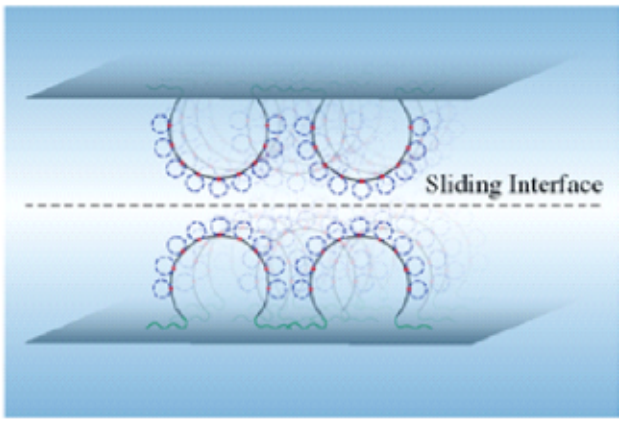
Dr. Joydeb Mandal

Assistant Professor Grade I

Polymeric Interfaces:

Nature uses some biologically abundant macromolecules such as carbohydrates, proteins and glycoproteins to design its interfaces. These molecules interact synergistically with each other and with the tissue surface to form a hairy/brushy polymeric layer which helps in maintaining a thin hydration layer at the biological interfaces. Such a hydration layer plays a crucial role in the smooth functioning of the interfaces by providing lubrication and suppressing non-specific protein adsorptions. Dr. Joydeb Mandal is working on the development and assembly of surface-active polymers to imitate such biological interfaces with an aim to develop bio-passive coatings and materials for life science and MedTech applications such as contact lenses, stents and prosthetic implants.





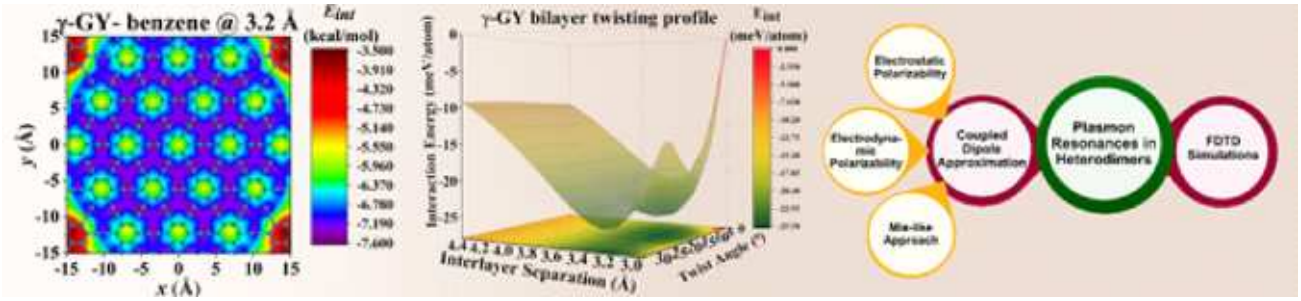
THEORETICAL CHEMISTRY

Dr. R. S. Swathi

Associate Professor

Multiscale Modeling and Computation of Nanostructures

Modeling of nanostructures necessitates a mix of modeling methodologies ranging from empirical and semi-empirical approaches to highly accurate quantum chemical approaches. Research at Dr. R. S. Swathi's multiscale modeling and computation group is directed at development and implementation of theoretical approaches for probing interesting phenomena involving carbon-based as well as metal-based nanostructures. Recently, Swathi's group has proposed empirical interlayer potentials for modeling (i) multilayer graphyne configurations, (ii) adsorption of noble gases on boron nitride sheets, and (iii) polycyclic aromatic hydrocarbons on graphynes. The predicted findings can serve as useful starting points for researchers performing high-level ab initio calculations and force-field simulations. In recent times, the group has also employed approximate analytical approaches based on coupled dipole approximation and electrodynamic polarizabilities to evaluate the optical properties of a range of plasmonic heterodimers such as Au-Ag core-shell architectures that are of potential use in surface-enhanced spectroscopy.

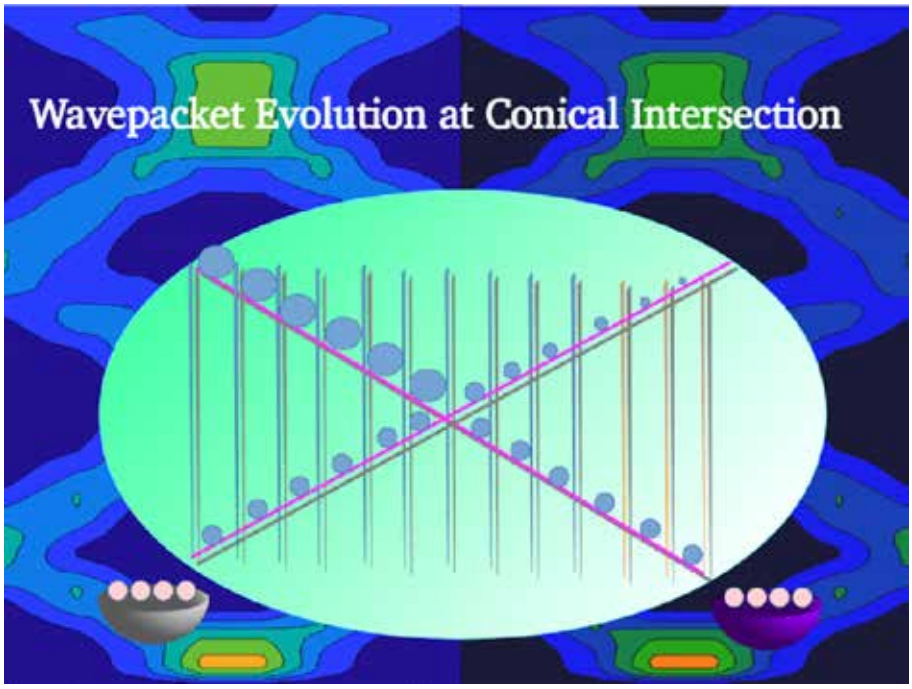


Potential energy surfaces for the adsorption of benzene on graphyne and twisting of bilayer structure of graphynes along with a schematic of the approaches for modeling plasmonic resonances in nanostructure heterodimers.

Dr. Vennapusa Sivaranjana Reddy

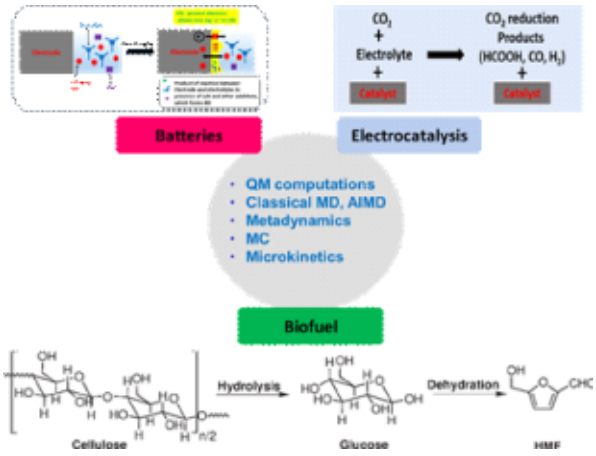
Assistant Professor Grade I

Understanding the events happening at the conical intersection of potential energy surfaces is crucial for the unambiguous interpretation of experimental ultrafast time-resolved spectroscopy measurements. Dr. Sivaranjana Reddy's group investigates such events by monitoring the wavepacket evolution under the influence of model vibronic Hamiltonians. Both singlet and triplet excited state manifolds are taken into account to explain various photoinduced processes ranging from intramolecular proton transfer to triplet generation to fluorescence emission. Multiple proton transfer pathways in several medium-sized molecules and efficient intersystem crossing channels in large molecules (cycloparaphenylene, traphenylporphyrin, perylene diimide derivatives) have been identified. Those findings necessitate a substantial revision of conventional models for the photon conversion processes. Dr. Reddy's future research aims to develop critical parameters involved in producing white light emission originating from the broad emission features of proton transfer tautomerism. Outcomes of such a study might help make efficient and environmentally friendly display and lighting devices.



Dr. Sooraj K

Assistant Professor Grade I



The growing global energy demands, continuous depletion of conventional fossil-based energy sources and the environmental hazards associated with their application necessitates the search for green and renewable energy sources. Though, there are several naturally available renewable energy sources such as solar, tide, wind etc., their practical applications are limited due to their dependence on the climatic and geographical changes as well as the requirement of efficient grid-based energy storage systems. We would like to contribute to the ongoing research in the area of renewable energy production and energy storage by performing computational studies on challenging and interesting problems in the field of Li- and post-Li ion batteries, chemical reactions related to biofuel production and electrocatalysis. Well-established computational approaches such as electronic structure calculations, molecular dynamics, Monte Carlo simulations, enhanced sampling techniques and microkinetic modeling will be using for these studies.The research problems that are currently going on in our lab are given below:

Batteries

1. Mechanism and kinetics of solid electrolyte interface formation in Li and post-Li ion batteries

2. Effect of dopants on the electrochemical properties of Ni-rich NCM ($LiNi_xCo_yMn_{1-x-y}O_2$) cathode materials for Li ion batteries (with Prof. Dan T. Major, Bar-Ilan University, Israel)
Recent publications: J. Electrochem. Soc. 2021, 168, 060552; Materials 2021, 14, 2070

Biofuels

Mechanism and kinetics of humins formation during the dehydrdation of glucose to hydroxymethylfurfural (HMF) and its impact on the overall kinetics and yield of the HMF formation reaction.

Electrocatalysis

Role of electrode-electrolyte interface in electrocatalytic oxygen evolution and CO_2 reduction reactions
In addition to these we are also working on collaborative projects with experimental groups on interesting problems in chemistry.
Recent Publication: *Chemistry A European Journal,* 2021, https://doi.org/10.1002/chem.202101360.

SCHOOL OF BIOLOGY

Biophysics & Structural Biology

Dr. Ramanathan Natesh

Assistant Professor Grade I

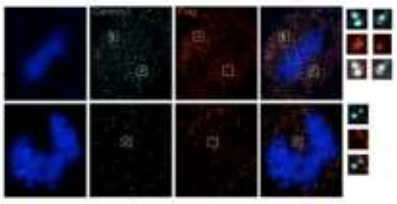


Fig. Upper panel: SAS-6 WT expressed cell; Lower panel: SAS-6 C-terminal deleted cell

Structural Molecular Biology

Dr. Natesh's lab is interested in structure, function and molecular mechanism studies of proteins, protein-protein, protein-DNA/RNA and Protein-Drug complexes involved in human health and disease. Our current focus is on players in transcription and its regulators in Mycobacterium spp. and proteins involved in human anomalies like cancer. We have recently shown that the tetrameric p53 exhibits thermal instability with increased hydrophobicity. The tetrameric p53 exhibits rapid loss of DNA binding at physiological temperature, and exhibits higher aggregation compared to its dimeric and monomeric variants (*Luwang* et. al., 2021, *Biochimie*). Our findings explain the predominant existence of p53 in dimer and monomer forms in vivo with a lesser population of tetramer form. In yet another work we showed that hypomorphic mutations in human DNA ligase IV lead to compromised DNA binding efficiency, hydrophobicity and thermal stability (Maddi et. al., 2021 PEDS).

Cell Biology

Prof. Tapas K. Manna

Professor

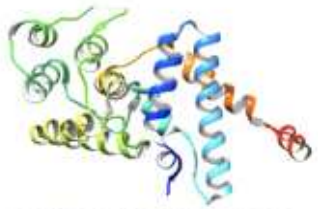


Fig. The crystal structure of A3V mutant of DBD Ligase IV

Chromosome & Centrosome Biology

Prof. Tapas Manna's research has elucidated the molecular basis of microtubule formation during the biogenesis of daughter centriole in the centrosome. Specifically, his group has identified a key role of the centriolar cartwheel protein SAS-6 in microtubule assembly and the study exposes a novel molecular link between the cartwheel and microtubule triplet formation in the centriole. The work provided for the first time a critical involvement of the gamma-tubulin ring complex interaction with SAS-6 in the formation of microtubules of the centriole. The work has been published in the prestigious Cell press journal Current Biology (Gupta et. al., 2020). Their work also unraveled a fundamental mechanism by which centrosome amplification is controlled in cells. They identified a crucial role of a tumor suppressor ubiquitin ligase, FBXW7 in controlling centriole amplification by targeting centriole duplication protein (J. Biol. Chem. 2020).

Dr. Kalika Prasad

Assistant Professor Grade I

Cellular Reprogramming & Developmental Plasticity

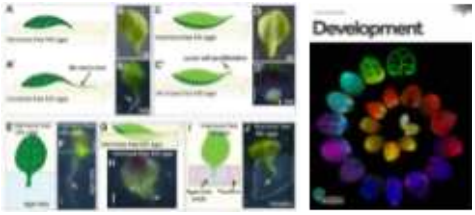


Fig. Schematic demonstrating touch-stimulated de novo root regeneration(left) and Cover page of Radhakrishnan et al., 2020 Development (right).

Dr. Kalika Prasad's Lab focuses on studying plant regeneration using Arabidopsis as a model. His group studies the mechanism underlying a multitude of regenerative responses ranging from mechanical injury-induced to tissue culture-induced regeneration. They recently elucidated the mechanism mediating the regeneration of vascular tissue in leaf, where the vasculature was disconnected owing to mechanical injury. They established a new system to study the recognition, communication and re-union of two physically separated tissues in leaf. Using a combination of mutants, transient pulse of overexpression lines of key cell fate determinants as well as by tracking the expression of early vascular identity marker ATHB8 and polar auxin transporter PIN1 in real time, they revealed that PLT-CUC2 axis is required for proper cell polarization and fate determination during vascular regeneration. In addition, they showed that the factor favoring root organogenesis is the direct physical contact of the cut end to any solid or liquid surface. They further show that PLT genes, which are essential as well as sufficient for root formation, regulate this process via a mechanism distinct from other PLT-regulated known regenerative responses.

Dr. Jishy Varghese

Assistant Professor Grade I

Nutrient Homeostasis

Fig. Blocking Lumens interrupted gene in DILP2 expressing affects larval growth and defects in tracheal morphogenesis upon blocking insulin

Dr. Jishy Varghese's is interested in studying mechanisms that aid an organism in withstanding fluctuations in the environment. Towards this we use Drosophila melanogaster, and study the molecular responses elicited in response to changes in the nutrient environment. Recently, we identified a novel mechanism by which insulin signaling aids in hunger induced feeding responses, by activating a feedback regulatory loop which involves nutrient sensing neural centers (Sudhakar et al 2020 Dev Biol). Further, we identified the molecular mechanisms by which adult flies elicit predictive adaptive responses to larval diet (Rehman and Varghese 2021 PLOS One). We also identified novel regulators of insulin signaling that act in the nutrient sensitive fat body and oxygen sensing trachea (Pathak et al 2021 Genetics; Pathak and Varghese 2021 Life Science Alliance). We continue to work on various diet conditions and genetic means to evaluate various strategies of the organism to maintain an internal nutrient/energy balance.

Dr. Satish Khurana

Assistant Professor Grade I

Stem cell proliferation and haematopoiesis

Dr. Satish Khurana's group focuses on the functional regulation of hematopoietic stem cells (HSCs) during developmental and adult hematopoiesis. Continuing their work to understand the involvement of integrin signaling, they reported that hematopoietic activity in the mouse spleen is regulated by the interaction between Periostin (Postn) and its receptor integrin-av (Itgav). In addition, the lymphopoietic activity in the spleen with Vav-iCre mediated Itgav deletion was altered, resulting from decreased white pulp area. Spleen that lacked Postn expression supported the incoming transplanted HSCs poorly (Mehatre SH et al. in J. Immunol. 2021). These studies are being explored further using extramedullary hematopoiesis models such as G-CSF injection and pregnancy. Recent findings established a clear link between outside-in integrin signaling and chemokine Sdf-1α, which plays a key role in HSC mobilization. Modulation of integrin signaling is being exploited to achieve enhanced hematopoietic function or mobilization.

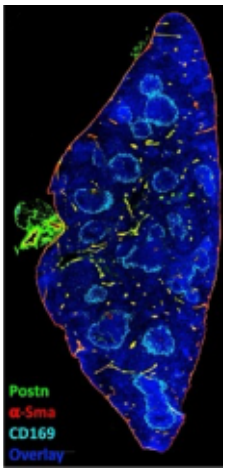


Fig. Postn expression in the vascular region of the spleen, along with vascular endothelial staining using ant-CD31 antibodies. ECM is labelled with laminin

Ecology & Evolution

Prof. Hema Somanathan

Professor

Fig. PhD student Asmi Jezeera conducting field studies on bees.

Behavioral and Evolutionary Ecology

Prof. Hema Somanathan's lab is interested in questions related to the behavioral ecology and the pollination services provided by bees. We have in the past year, examined the spatial resolution of the eyes of Indian honey bees and stingless bees. This enables us to examine interspecific differences in the visual ecology of bees across various habitats. We have found that honey bees have foraging ranges that are much smaller than the western honey bee, Apis mellfiera.These differences may arise from differences in the resource distribution patterns in tropical and temperate habitats. We are currently examining their foraging ecology in varied landscapes in an attempt to construct forage maps and pollination networks in both forest and in agroecosystems. We are also examining various defensive behaviors in social bees and studying their seasonal migration patterns across Indian landscapes.

Dr. Ullasa Kodandaramaiah

Associate Professor

Fig. Adaptive pupal colour plasticity in Mycalesis mineus

Evolutionary Ecology of Diversification

Dr. Ullasa Kodandaramaih's lab tries to understand the evolutionary patterns and processes of diversification. Some of the major research highlights over the last one year include work that has 1) shed light on how butterflies benefit from pupal color plasticity to enhance camouflage and reduce predation 2) demonstrated multi-modal sensory integration and context specificity in color preferences of butterflies 3) habitat specialization leads to morphological diversification in Impatiens plants 4) how features of the environment - complexity and heterogeneity - influence crypsis in animals 5) how conspicuous, warning colors in uropeltid snakes have influenced diversification of this group.

Genetics & Genomics

Dr. Nishant KT

Associate Professor

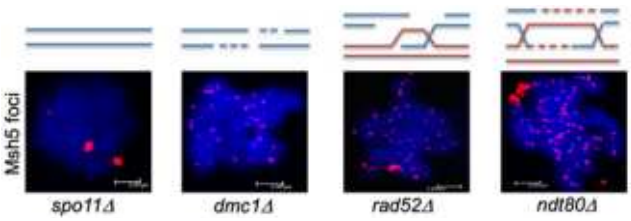


Fig. Msh5 binding is stimulated by Holliday junction formation.

Genome stability

Dr. Nishant' s group is interested in understanding mechanisms that maintain genome stability during mitotic and meiotic divisions using the budding yeast Saccharomyces cerevisiae as a model system. Two major research areas in the lab are: 1) Mechanisms of meiotic recombination and chromosome segregation 2) Mechanisms contributing to mutations, loss of heterozygosity (LOH) and aneuploidy during mitotic divisions. During 2020-2021, the group has provided insights into the mechanism of meiotic crossover formation through the mismatch repair related Msh4-Msh5 complex. His group show that Msh5 specifically associates with DSB hotspots, chromosome axes, and centromeres on chromosomes (Krishnaprasad et al., Genetics 2021). We also show that during meiosis, Msh5 binding is stimulated by Double Strand Break repair intermediates such as Holliday junctions that are processed into crossovers using the endonuclease domain of Mlh1-Mlh3. These findings are important towards understanding the mechanism of meiotic Holliday junction resolution in eukaryotes.

Dr. Ravi Maruthachalam

Assistant Professor Grade I

Fig. Stunted growth of GFP-NNF1 complemented nnf1-1 mutants

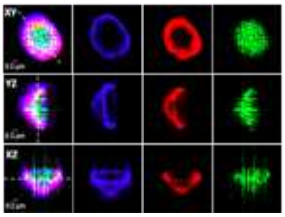
Uniparental Genetics

Dr. Ravi Maruthachalam's lab is interested in understanding and exploiting the phenomena of centromere- mediated uniparental genome elimination (UGE) in plants using Arabidopsis thaliana. UGE is triggered by manipulation of centromeres during embryonic mitosis. To understand its mechanism, it is important to examine the plant centromere-kinetochore architecture, which controls the chromosome segregation machinery. More than 100 proteins are known to constitute the eukaryotic kinetochore architecture, primarily identified using non-plant models. However, functional characterization of the plant kinetochore proteins is limited. In an attempt to characterize unknown plant kinetochore proteins, this year we concluded a study on the functional characterization of the Arabidopsis homolog of the yeast NNF1/human PMF1 outer kinetochore protein, AtNNF1 and show that it has both kinetochore and non-kinetochore function influencing plant growth and development. With the aid of hypomorphic and antimorphic alleles, we demonstrate a moonlighting function for Arabidopsis NNF1 affecting polyamine and gibberellin metabolism.

Infection & Immunology

Prof. S. Murty Srinivasula

Professor



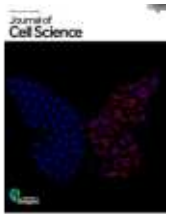


Fig. Super resolution images exhibiting the structural composition of ALIS (left). Cover image of S.V. Nair et al., JCS.

Immune Cell Biology

Prof. Murty's group broadly aims to unravel molecular signaling pathways that control organelle homeostasis under different stress conditions like infection. In this regard, the lab focuses on ubiquitin signaling, organelle dynamics, and host-pathogen interactions. The group demonstrated that tumor-associated variants of RNF167 promote lysosomal exocytosis and plasma membrane resealing, which might contribute to tumor progression. The group also found that some of these tumor-associated mutations show increased NF-kB activation in TNF alpha-treated cells. Moreover, the lab has characterized ALIS (Aggresome Like Induced Structures) and shows that antibacterial peptides get enriched in ALIS in response to bacterial infection. We also collaborated on various aspects of interdisciplinary research. We showed that Vanadium pentoxide nanoparticles induce autophagy. Our group also focuses on unraveling cellular mechanisms that control selective autophagy, mitophagy, and Golgi dynamics. Our findings revealed a novel function for endosomes in the removal of damaged mitochondria involving Parkin.

Dr. V Stalin Raj

Associate Professor

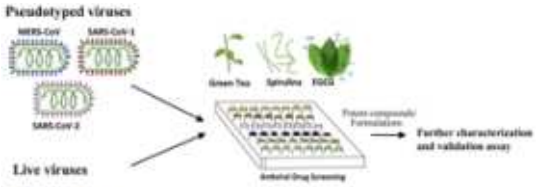


Fig. Schematic depicting the use of pseudotyped viruses for screening of antiviral activity of natural products.

Virology

Dr. Stalin Raj's lab studies the entry mechanism of coronaviruses using a pseudotyped coronavirus model system. Coronaviruses (CoVs) belong to the family of Coronaviridae, which have a positive-sense RNA genome including the recently emerged pandemic SARS-CoV-2. Medicinal plants and natural compounds have been traditionally used as antivirals. Here, we generated a VSV-based surrogate model (pseudotyped viruses) for recently emerged highly pathogenic coronaviruses to screen entry inhibitors from natural products. First, we demonstrated the use of pseudotyped coronaviruses in screening of entry inhibitors. Incubation of soluble form of SARS-CoV-1 and -2 receptor ACE2 with CoV-PVs inhibited entry of SARS-CoV-1 and -2 PVs but not MERS-CoV-PV. Also, surface expression of ACE2 and DPP4 in non-permissive HEK293T or BHK21 cells enabled infection by SARS-CoV-1-PV, SARS-CoV-2-PV, and MERS-CoV-PV, respectively. Next, we showed the antiviral properties of Spirulina and green tea extracts against CoV-PVs. SARS-CoV-1-PV, MERS-CoV-PV, and SARS-CoV-2-PV. Further, we demonstrated that the major catechin of green tea, Epigallocatechin-3-gallate (EGCG) binds on the receptor-binding domain (RBD) of SARS-CoV-1, SARS-CoV-2 and MERS-CoV and interferes the interaction with their respective cellular receptor ACE2/DPP4. This study put forward a potential lead molecule for the development broad-spectrum antivirals against emerging coronaviruses.

Molecular Biology

Dr. N. Sadananda Singh

Assistant Professor Grade I

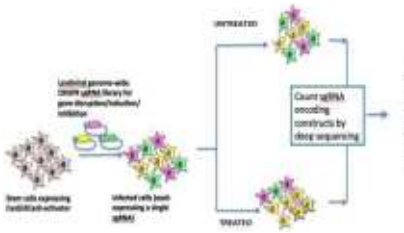


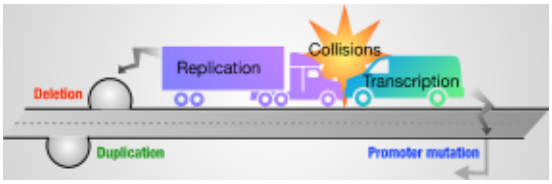
Fig. Steps involved in CRISPR-Cas based genome-wide screening for better understanding of drug response and related biological process.

Gene Regulatory Networks

Dr. Sadananda Singh's Lab focuses on studies in understanding the molecular mechanism of drug response, especially those drugs which affect DNA topology, DNA repair and cytoskeleton. Towards this, we extensively used genome-wide genetic screens using CRISPR-Cas technology. The current research focuses on the molecular mechanism of doxorubicin cytotoxicity. Recently, it has been observed that a less studied zinc-finger protein is involved in doxorubicin cytotoxicity and we are in the process of deciphering its molecular function using various molecular, biochemical and cell biological techniques. We are also interested in studying the genetics of cholesterol level disorder and adverse drug reaction. We have carried out the genetics of antiepileptic drug induced teratogenicity.

Dr. Sabari Sankar Thirupathy

Assistant Professor Grade I



Molecular Conflicts

Dr. Sabari Sankar Thirupathy's group aims to understand how collisions between replication and transcription generate mutations. Replication and transcription are the two fundamental processes that use the same DNA template often simultaneously especially in rapidly dividing bacterial cells resulting in collisions between the two machinery (Figure). Two major mutation signatures were identified as resulting from collisions: Indels (insertions/deletions) and promoter base substitutions. They are investigating the mechanisms of the mutations generated by replication-transcription collisions. Further, they study how genome organization is influenced by the conflicts between DNA replication and transcription

Neurobiology

Dr. Nisha N Kannan

Assistant Professor Grade I

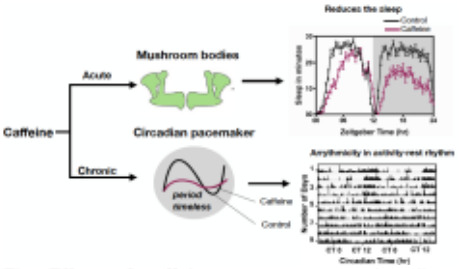


Fig. Effect of caffeine treatment on circadian rhythmicity.

Chronobiology

Dr. Nisha N Kannan's group is interested in understanding the circadian clock at the genetic, neuronal network level and how the circadian clock rhythmically regulates the behavior, physiology and metabolism of an organism. Although evidence from previous studies showed that caffeine promotes wakefulness it is important to understand whether caffeine influences sleep via the endogenous time keeping system. Recent studies conducted by the group showed that acute caffeine treatment reduces sleep through the homeostatic pathway whereas prolonged caffeine treatment disrupts the circadian rhythm in flies. Most importantly, caffeine disrupted the transcriptional rhythm of core clock genes such as period and timeless. Our studies provide new insights into the action of caffeine on circadian clock machinery and the impact of low, moderate and high concentrations of caffeine on clock mediated behavioral rhythmicity in Drosophila

Dr. Poonam Thakur

Assistant Professor Grade I

Neurodegeneration

Dr. Poonam Thakur's lab is interested in understanding the pathophysiology of Parkinson's disease (PD), a progressive debilitating movement disorder, characterized by accumulation of α-synuclein aggregates (Lewy bodies) and degeneration of dopaminergic neurons (DA-neurons). We particularly focus on finding molecular mechanisms behind selective vulnerability of some subgroups of neurons to degenerate during PD. To aid in this process we utilize the progressive mouse models that can accurately mimic the complex pathophysiology of the disease. These models are based on selective overexpression of α-synuclein in the brain regions affected during PD. In addition, we also focus on the biophysical mechanisms that drive the aggregation of α-synuclein protein in the pathological conditions presented during PD. The insights obtained from these methods have the potential to provide deeper insights into disease mechanisms that can be targeted for therapeutics.

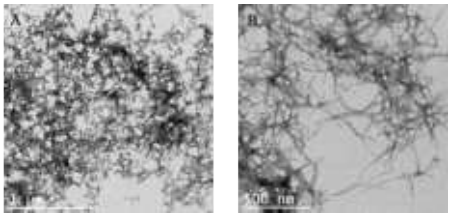


Fig. TEM images of monomeric α-synuclein (left) aggregated form of α-synuclein (right).

AWARDS & ACHIEVEMENTS

Research Group	Recognitions
Prof. S. Murty Srinivasula	Rishith Ravindran, a PhD student received EMBO short-term fellowship to visit University of Bristol, UK Nikhil Dev, a PhD students received Newton-Bhabha fellowship to visit University of Dundee, UK Anushree Bhatnagar, a PhD student received ASCB-EMBO travel award to attend the ASCB | EMBO 2019 meeting in Washington DC, USA.
Prof. Hema Somanathan	Associate Editor - Frontiers in Insect Science Editorial Board - Current Science Jury Member - Inspiring Science Award Founding Member, Indian Pollinator Initiative Baheerathan Murugavel, a PhD students received Bat conservation international grant Bharat Parthasarathy, a PhD student received Humboldt fellowship for post-doctorate.
Prof. Tapas K Manna	Binshad B, a PhD student received post-doctoral fellowship
Dr. Nishant K.T	Invited Guest Editor for a special issue of the journal Yeast (Publisher: John Wiley & Sons Ltd, USA), 2020 Jury member for Inspiring Science Award for the best published scientific paper in the Life Sciences from India (Cell Press, 2019, 2020)
Dr. Ullasa Kodandaramaiah	Associate Editor of Proceedings of Royal Society B Editorial board member, Current Science

Dr. Jishy Varghese	Executive Committee Member, Indian Society for Drosophila Researchers
	Reviewer for NCBS-TIFR, Annual talks: 2020 Poster sessions
Dr. Ramanathan Natesh	Founding President of Cryo Electron Microscopy and 3 Dimensional Image Processing(CEM3DIP) Society of India (2018-2021).
	EMBO practical cryoEM course CEM3DIP 2022 grant Award, co-organiser (2021).
	MHRD STARS grant Award (2020).
	Dr. Sandrea M Frances, postdoc received KSCSTE Back To Lab Post-Doctoral Fellowship.
Dr. Ravi Maruthachalam	Invited reviewer for SERB-ACS online research poster competition
	Invited reviewer for CSIR-FIRST scheme grant proposals
Dr. Kalika Prasad	Mabel Maria Mathew, a PhD student was awarded Prime Minister's Research Fellowship (PMRF)
	Chosen to write leading edge primer article in Development journal (For the first time in area of plant regeneration)
	Research article by the lab was selected as a research highlight and featured as the cover page of Development (Cambridge)
	Cover Image by the lab was selected as most celebrated image by the Journal, Development (Cambridge)
	Research article by Anju PS et al in Plant Physiology was selected as article of the week in Plant Physiology journal by signal magazine of American Society of Plant Biologists (ASPB).
	Anju PS, a PhD student was chosen for spotlight and featured on signal magazine published by ASPB.

Dr. V. Stalin Raj	Co-opted Member of the Expert Committee-Life Sciences on Start-up Research Grant (and National Post-doctoral Fellowship Schemes under SERB, DST
	Member of the SERB Taskforce on COVID 19 to evaluate the proposals submitted under CRG and IRHPA
	Member, Scientist screening committee at Institute of Advance Virology, Government of Kerala
	Member, Technical and Expert committee member of Institute of Advance Virology, Government of Kerala
	Special Scientific and Technical Appraisal and Advisory Groups (STAG) Committee member to evaluate the proposals submitted under the DBT-BIRAC joint call on Globally Accessible and Cost-Effective Novel Antibodies (May 2020)
	Member, Board of Studies "Medical Biotechnology" Bharathiar University Coimbatore, Tamil Nadu
	Nodal officer at ICMR approved COVID19 testing laboratory, IISER TVM
	Editorial Board member: Frontiers in Virology
	Appearance on Doordarshan National live television programmes o Samoohyapatam "Viruses, Virus discovery, Vaccine, and Emerging Coronaviruses" on 09.11.2020 o Samoohyapatam " COVID 19 Virus - mutation, spread, vaccine " on 24.05.2021
Dr. Satish Khurana	Continuous reviewer for CSIR FIRST scheme
	lnvited area expert grant reviewer for MRC, UK
Dr. Nisha N Kannan	Zoological Science Award 2020 from the Zoological Society of Japan
	Fuji award for the recent publication from lab
	Executive committee member, Indian Society for Chronobiology
Dr. Poonam Thakur	Resource person for the EMBO-IndiaBioscience Workshop on Oral Communication in Science (January, 2021)
Dr. Sabari Sankar Thirupathy	Anjali Variyar, a PhD student selected to present in the PMRF National Symposium

IISER Thiruvananthapuram Covid-19 Diagnostic Centre

IISER-Thiruvananthapuram set up a state-of-the-art Diagnostic Centre for testing COVID-19 clinical samples with approval from ICMR. The diagnostic Centre was inaugurated by the Director, Prof. J. N. Moorthy on 18th August, 2020.

Salient Features :

- Level-2 Biosafety facility
- Virus burn out unit
- Sample collection | preparation | addition
- RT-PCR
- Data entry & Storage
- Donning & Doffing of PPE | Shower
- Monitored by School of Biology Faculty

Workforce :

- Well-trained Technical Assistants from School of Biology
- More than 25 well-trained PhD students

Functioning :

- Samples for diagnosis received from the State Govt. of Kerala through the District Medical Officer since 06 Oct 2020
- A set of 10 random samples (5 positive and 5 negative) are being regularly sent to National Institute of Virology (NIV) for quality control check under Inter Laboratory Quality Control (ILQC) Program

Contributions :

- Screening crossed 10,000 samples by RT-PCR method
- No conflict of result has been reported from NIV to date

SCHOOL OF PHYSICS

Dr. Amal Medhi
Assistant Professor Grade I

How does the Hund's exchange coupling affect the electronic properties of a multi-orbital material where electron-electron correlations are strong? Can Hund's coupling lead to itinerant ferromagnetism? Dr. Amal Medhi's group addressed these questions using a multi-band Hubbard model, which they solved using variational slave-spin mean field theory. It was found that Hund's coupling drives the system into a fully polarized ferromagnetic phase and has contrasting effects on the electronic properties depending upon the value of electron-electron interaction strength.

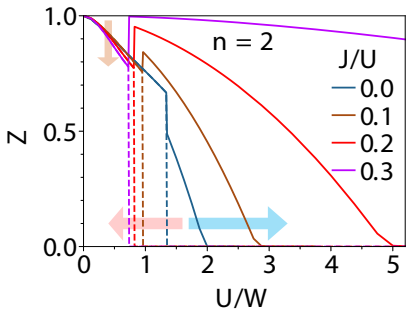


Figure 1: In a 3-band Hubbard model with n=2 electrons per atom, Hund's coupling J reduces quasi-particle weight Z at smaller Hubbard interaction strength U while increasing it at higher U. Ferromagnetic ordering appear at small U for higher J.

The machine learning approach to learn quantum many body systems has been an exciting area. The group is studying various neural-network based wave functions to represent the ground state of the fermionic Hubbard model. Neural-network architectures, such as a feed forward neural-network, restricted Boltzmann machine (RBM) etc have been explored. Out of these, a convoluted RBM based wave function is found to be very good approximation to the true ground state of the Hubbard model. Further works in this direction are in progress.

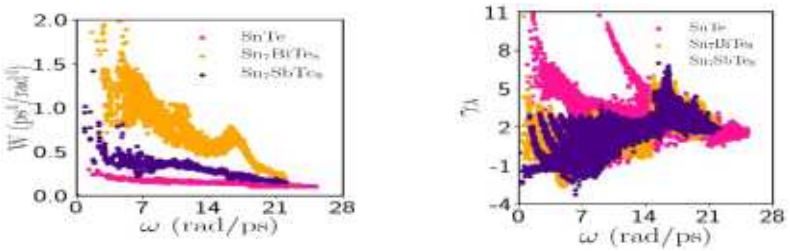


Figure 2: Effects of Bi and Sb doping on the three-phonon processes (left) and anharmonicity (right) of SnTe, a promising TE material.

On another topic on thermoelectric transport properties of materials, Dr. Amal Medhi's group examined how doping which is used to control carrier densities in thermoelectric (TE) materials affects its lattice thermal conductivity. Does doping always reduce lattice thermal conductivity via enhanced phonon scattering and thus leads to a high thermoelectric efficiency? By using first-principles calculations on one promising thermoelectric materials SnTe, they showed that the answer depends upon how the doping affects two crucial phonon properties – allowed phase space volume for three-phonon processes and the anharmonicity of the material. While doping increases the former enhancing the phonon scatterings, it can lower the overall thermal conductivity giving rise to a higher thermoelectric efficiency only if doping does not reduce the anharmonicity substantially.

Dr. Deepshikha Jaiswal Nagar

Assistant Professor Grade I

Dr. Deepshikha Jaiswal-Nagar's group has a wide-ranging research interest in Superconductivity, Strongly correlated electron systems, Nanocluster Physics, Solid State hydrogen storage and Hydrogen sensors. Some of the broad sub-areas of interest include vortex state of superconductors, quantum phase transitions, entanglement in low dimensional spin systems, charge transport at nanoscales etc. Her group is also working actively on the synthesis and characterization of green energy storage materials (nanocluster films, metal hydrides, intermetallic, and metal organic frame works) to meet up the DOE targets. Besides, high performance hydrogen gas sensors are also being developed in her lab. Recently, her group has published a high performance chemiresistive hydrogen sensor which has shown better sensitivity than the previously reported sensors.

Dr. Deepshikha has established her laboratory with home-built set-ups like nanocluster deposition system, Surface acoustic wave sensor, resistivity-based hydrogen sensor, capacitive dilatometry, detwinner-cum-annealing assembly etc. These projects are funded by the Department of Science and Technology and Indian Space Research Organization, Government of India.

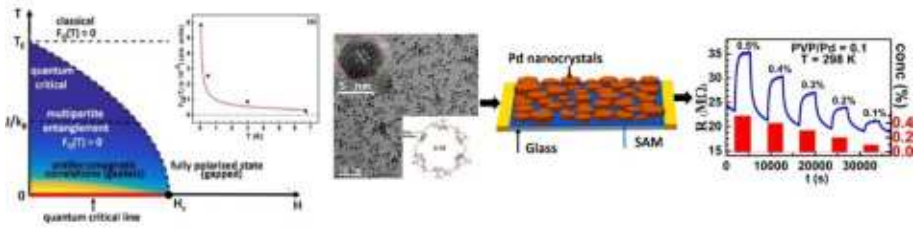


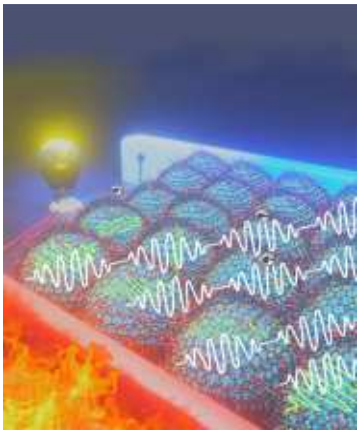
Figure: Multipartite entanglement driven quantum criticality and highest reported sensitivity chemiresistive hydrogen sensor.

Dr. Vinayak B. Kamble

Assistant Professor Grade I

In the year 2021, our SMaRT lab made a significant number of publications spanning over sensors, thermoelectric, optoelectronics etc. In our recent work published in ACS Applied Materials and Interfaces we reported an enhancement in thermoelectric figure of merit of ZnO which is an environmentally friendly material, though with a low ZT. Here we showed that incorporation of trace Al donors and encapsulating these ZnO nanoparticles with reduced graphene oxide sheets not only improves the power factor, but also leads to drastic reduction in thermal conductivity through selective phonon scattering. This work was done in collaboration with Dr Joy Mitra's lab, who performed Scanning tunneling spectroscopy on the same to show a drastic change in effective band gap from 3.4 eV to nearly 0.5 eV.

In another study we reported the set of surface photovoltage (SPV) measurements on ZnO nanorods when illuminated on prismatic planes. (Journal of Materials Science: Materials in electronics) The study is done using an in-house built Kelvin Probe system with photoexcitation of visible and UV wavelength lasers. This also led to deducing the minority carrier recombination length in this system which is found to be about 160 nm. This value is relatively low due to high defect concentrations which also act as recombination sites. The effect is enhanced in presence of atmospheric oxygen which acts as surface states.



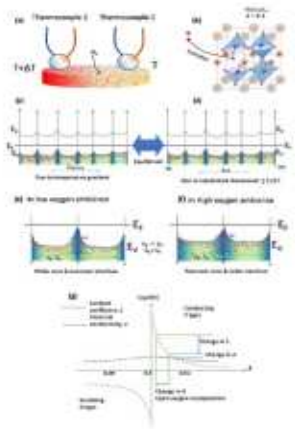


Figure 1: The cartoon of RGO encapsulated Al:ZnO nanoparticles and
Figure 2: GdBaCo2O5+δ showing selective carrier scattering led to energy filtering and corresponding change in thermopower (S) with oxygen deficiencies

Similarly, we presented a proof-of-concept oxygen sensor using thermoelectric principles which exploited dependence of thermopower on lattice oxygen vacancies. The study is published in the Journal of Applied Physics. An in-house built seebeck coefficient measurement system for 300-600 K temperature range was reported in Review of Scientific Instruments. A book chapter was contributed on Reduced graphene oxide photodetector devices for Infra-red sensing in an edited book published by Springer.

Dr. Madhu Thalakulam

Associate Professor

Electrical transport at quantizing dimensions is enriched by a number of exotic phenomena: quantum Hall effect, fractional quantum Hall effect, conductance quantization, flux-quantization, Aharanov-Bohm effect, single-electron tunnelling, topologically protected states, etc., are a few to mention. One important figure-of-merit of any scientific phenomena is its applicability in device technology. The outlook of Madhu Thalakulam group is to study, tailor, and utilize various quantum transport phenomena for improving our understanding of fundamental problems, pushing the limits and revolutionizing device technology. The Group currently focus on the realization of quantum devices on layered systems and spin qubits Si/SiGe and GaAs-/AlGaAs heterostructures.

In a recent work (https://doi.org/10.1088/2058-9565/ac107f) the group has demonstrated quantum shot-noise limited electrical amplification using a hybrid device consisting of quantum point contact coupled to a planar superconducting cavity. The resonator, made of Aluminium with a coplanar waveguide geometry, is designed to operate at its first harmonic resonant mode ~ 3.4 GHz, where the reflected power from the resonator is amplitude-modulated by the conductance changes in the quantum point contact channel. From the cavity reflectance we extract a conductance sensitivity of 2.85×10-7 (e2/h)/√Hz (11.05 pS√Hz). This sensitivity translates to a unit signal-to-noise measurement time ~ 1.62 ns for a variation of 0.01 (e2/h) in the conductance. From the analysis of the noise characteristics of the device, we find that up to a few MHz of signal frequency the sensitivity is limited by the photon assisted shot-noise associated with the electron tunneling in the QPC channel. These devices will be the main contenders for spin qubit readout technique.

Dr. Tuhin Subhra Maity

Assistant Professor Grade I

The Functional Materials & Devices (FMD) group of Dr. Tuhin Maity engineers nanoscale functional materials (with at least one dimension below 100 nm) for use in energy-efficient electronic devices. Their focus is on manipulating strongly correlated oxide materials, and their spin-ion-charge interactions at nanoscale. The materials are prepared by various state of the art deposition facilities such as DC/RF sputtering, Pulsed Laser Deposition (PLD) and thermal evaporation.

Recently, in a Nature Communications paper, Dr. Tuhin Maity demonstrated room temperature ferroelectricity using 3D straining in nanocomposite films. He with other scientists also created a sizeable converse magnetoelectric effect at room temperature without any magnetic field bias in a practical system (published in Nature Electronics). These are proved to be interesting discoveries for sustainable room temperature electronic devices. The group has worked on another project for finding a tuneable vertical shift of the magnetic in hard/soft materials heterostructure. Popular magnetocaloric effect (MCE) is also being studied in parallel to find the effect of three-dimensional strain on the magnetocaloric properties of epitaxial thin films. The group members have attended and presented posters in the AIP conference on their works. PhD student Manisha has been selected to receive $5,000 educational seed funding from the IEEE Magnetics Society. The funding is for a collaborative project with Louise Colfer/Dr. Lynette Keeney from Tyndall National Institute (Ireland).

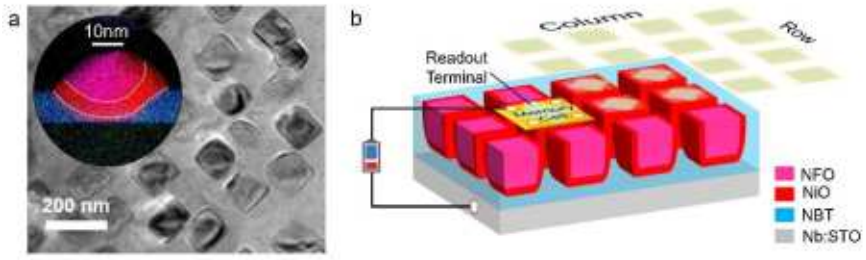


Figure 1. (a) Self-assembled triple composite.
(b) Memory circuit concept using vertically aligned triple composite.

The group focuses on finding solutions for low power, high density, ease in fabricating devices for neuromorphic Non-Volatile Memory (NVM) to reduce environmental impact while fulfilling consumer demand for the energy-hungry data driven digital world.

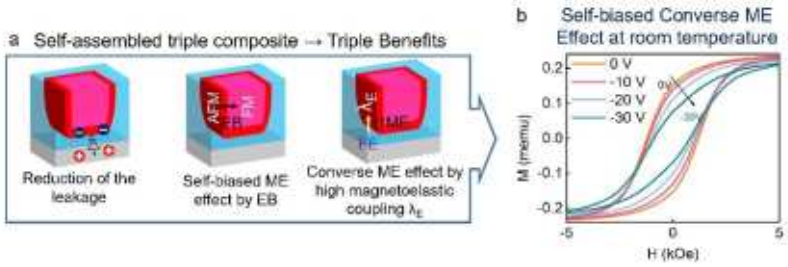


Figure 2. Three key functionalities (a) to achieve converse ME effect
(b) at room temperature in this self-assembled triple composite.

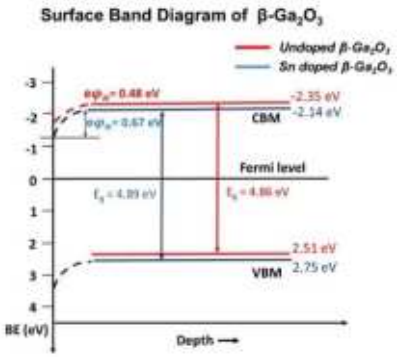
References: 1. R Wu, D Zhang, T Maity, et al.; Nature Electronics 4, 333–341 (2021) 2. C Yun, et al.; ACS Applied Materials and Interfaces 13, 7, 8863–8870 (2021) 3. J Halpin, et al.; IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control (2020) 4. E Choi, T Maity, et al.; Nature Communications 11, 2207 (2020)

Dr. Somu Kumaragurubaran

Associate Professor

Dr. Kumaragurubaran group focuses on the wide bandgap materials with a mission of practical device development. On the materials part, the group is currently interested towards diamond and gallium oxide and its alloys. Despite the fact that the processing technologies are established well over a decade, in terms of doping control and its activation they are still immature which are critical for the new device development as well as to enhance the performance of established devices. To overcome these barriers and also to gain the fundamental understating on the defect chemistry and electronic structure, we have been employing high-end characterization tools like Hard X-ray Photoelectron Spectroscopy (HAXPS), X-ray absorption spectroscopy etc. available at various global synchrotron radiation facilities. Figure illustrates the surface band diagram of Ga2O3 bulk crystal deduced from HAXPS and VBS studies.

The investigations being carried out both bulk and thinfilm forms and also with varied dopants to elucidate the defect structure and its impact on the electrical/electronic properties. For additional control and understanding of physical properties, we have been attempting to alloy Ga_2O_3 with other oxides such as In_2O_3 and Al_2O_3. For this purpose, we established a bilateral collaboration with NIMS, Japan to access the combinatorial materials synthesis facility, a disruptive rapid materials screening technique. As a derivative of this collaboration, a large number of data set will be made available for establishing artificial intelligence based materials discovery through materials information integration.



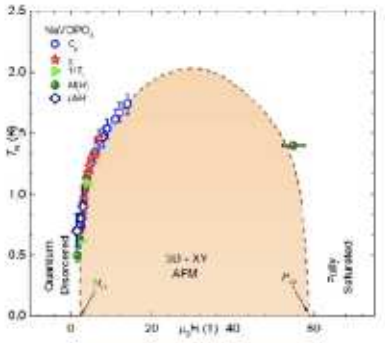
On the diamond part, the group initiated the microstructuring of diamond through focused ion beam and developed a method to recover the surface through a systematical processing techniques, which are critical for electronic and Nitrogen-Vacancy centre based quantum applications. By integrating various parts of our investigation, we hope to fulfil our mission.

Prof. Ramesh Chandra Nath

Professor

Prof. Ramesh Nath's group focuses on discovery of new materials based on transition metal and rare earth ions and investigate their structural, electronic, magnetic, thermal, and dynamical properties using various experimental tools under extreme conditions i.e. at ultrahigh and ultralow temperatures,under high magnetic field, and under high pressure. His research group aims at the fundamental understanding of the complex and emergent electronic and magnetic phenomena in strongly correlated electron systems and frustrated quantum magnets. In these materials, the charge, orbital, spin, and lattice degrees of freedom are often found to be intertwined with each other in such a way that it leads to a variety of macroscopic properties which are having both fundamental and applied importance such as high temperature superconductors, spin liquids etc. One of the main research focuses of his group is to investigate the novel quantum phases stabilized by competing exchange interactions in different low dimensional (i.e. spin-chain, spin-ladder, square-lattice) and frustrated (i.e. triangular, kagome,pyrochlore etc.) magnets. Various experimental methods (such as magnetization, heat capacity,resistivity etc) are used to investigate the physical properties of these materials. To probe the spin-dynamics of these quantum materials, they use NMR as a powerful local tool. They also apply variousexternal non-thermal parameters such as high magnetic fields, chemical pressure (doping) etc to manipulate the ground state, which can eventually drive the system towards quantum critical point and in some cases even leads to exotic quantum phase transitions. His group is also working on several intermertallic compounds with high temperature magnetic transitions to understand the nature of the magnetic transition and the associated magnetocaloric properties.

Currently, his group is also working on several rare-earth based quantum magnets. Strong competition between spin-orbit, on-site Coulomb and crystalline electric field interactions, which are unique to these group of materials, can trigger various non-trivial quantum states such as Kitaev model,quantum spin-liquid state, mott-insulating state etc.



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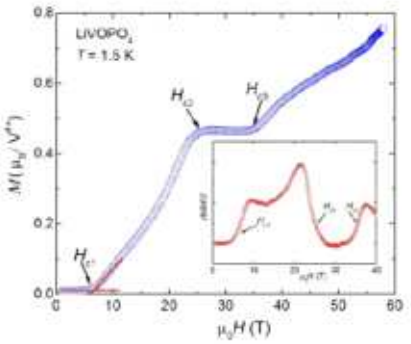

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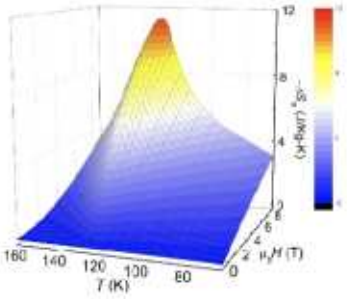

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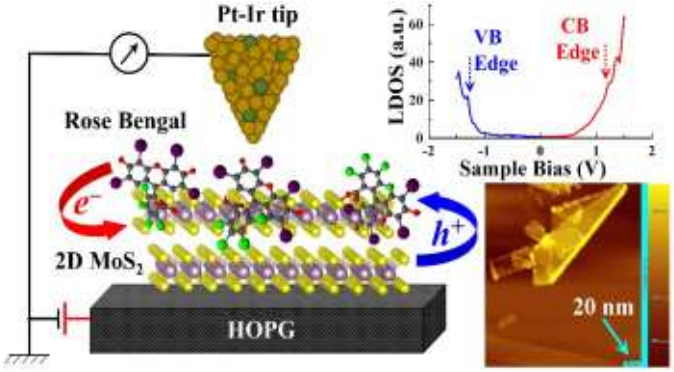
Energy: Photo voltaics, Thermoelectrics, Storage

Dr. Bikas C. Das

Assistant Professor Grade I

Our group is actively working on device physics using various promising advanced materials to show emerging electronic and optoelectronic applications that are highly energy efficient and robust. We have processed different materials such as 2D TMDs, semiconducting QDs, organic-inorganic layered nanohybrid materials, ultrathin dielectrics, polymer electrolyte, redox-electrolyte, transparent amorphous oxides (TAOs), and so on to show novel electronic and optoelectronic applications. Very recently, we have reported robust and highly reproducible non-volatile resistive switching (RS) devices with artificial synaptic functionalities utilizing redox-exfoliated few-layered 2H-MoS2 nanoflakes. Advantageous polar solvent compatibility of 2D MoS2 from the redox-exfoliation method was utilized to fabricate thin-film devices robustly using polystyrene as a matrix. We have confirmed the mechanism of charge transport by fitting the results with theoretical models. A relatively high current On/Off ratio of about 102 was recorded during the pump-probe testing to show resistive random-access memory (ReRAM) application. These RS devices are also utilized to demonstrate synaptic functions in the brain artificially, like memorization and depression (Nanotechnology 2021 32 (35), 35LT02).



In another collaborative work, we found the reversible polymorphic phase transition of $[Ni_6(PET)_{12}]$ (PET = phenylethanethiol) and its effect on the conductivity using conducting AFM (Chem. Commun. 2021 57 (23), 2935). Instead of processing organic solar cells inside an inert environment, we showed high efficient organic solar cells can be fabricated in an ambient environment using P_3HT as donor and $PC_{61}BM$ as acceptor. In the same report, we probed defects in the active layer of organic solar cells more precisely using conducting AFM (RSC Adv. 2020 10 (42), 24882). Ultra-high vacuum scanning tunneling microscope (UHV STM) is a versatile tool to probe the electronic structure of materials at nanoscale. Accordingly, we have probed the influence of small organic dye molecules on the electronic property of liquid phase exfoliated 2D MoS_2 flakes. We found that the p-type Rose Bengal (RB) molecules actually modulate the n-type nature of 2D MoS_2 flake after forming type-II heterojunctions (Appl Surf Sci 2020 530, 147063). Apart from these works, we have also published our works on Plasmon-Phonon interactions, ultralow voltage operated IGZO transistors using ultrathin anodized Ta, influence of anodization process on the dielectric performance of ultrathin anodized aluminium insulator films, and so on.

Dr. Manoj A G Namboothiry

Associate Professor

Dr. Manoj Namboothiry's group explores the semiconducting and optoelectronic properties of organic, organic-inorganic hybrid perovskites, 2D and nano-materials. Research in this group focuses on two aspects.

1. Device engineering leading to high efficiency optoelectronic devices.

2. Understanding the fundamental electrical, electronic and photo-physical properties using different electrical, optical spectroscopy and microscopy techniques which complement in developing high performance devices. Dr Manoj's group also focuses on instrumentation and calibration to develop custom made measurement setups. Some of the recent research work of this group include,

• Understanding the poor fill factor of solution-processed squaraine based solar cells in terms of charge carrier dynamics probed via impedance and transient spectroscopy. (J. Mater. Chem. C 8 (42), 14748-14756)

• Charge carrier dynamics and photovoltaic properties of near-infrared absorbing squaraine incorporated solution-processed additive-free PTB7:PCBM based ternary solar cells.

• Unsymmetrical Squaraine Dye-Based Organic Photodetector Exhibiting Enhanced Near-Infrared Sensitivity. (J. Phys. Chem. C 2020, 124, 39, 21730–21739)

• High-Performance, Transparent Solution-Processed Organic Field-Effect Transistor with Low-k Elastomeric Gate Dielectric and Liquid Crystalline Semiconductor: Promises and Challenges. (ACS Appl. Electron. Mater. 2020, 2, 3336−3345).

• Photoresponse of Solution-Processed Molybdenum Disulfide Nanosheet-Based Photodetectors. (ACS Appl. Nano Mater. 2020, 3, 10057−10066).

• The difference in the operational mechanism of p-i-n configured $MAPbI_3$-$PC_{71}BM$, $MAPbI_3$ and $MAPbI_x$ Cl_{3-x} based perovskite solar cells, owing to their composition and morphology are analysed on the basis of the interplay between mixed electronic-ionic phenomena and the internal electric field of the perovskite solar cells.

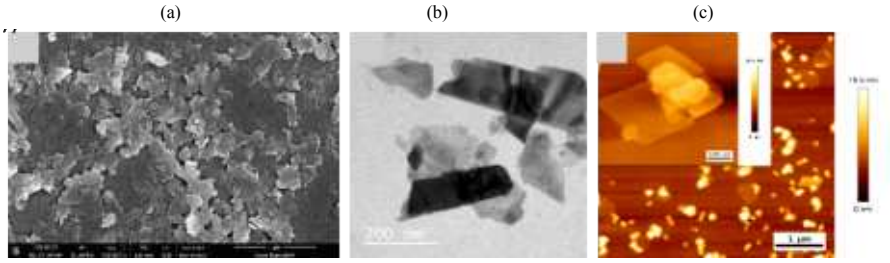


Figure 1. (a) SEM micrograph
(b) Transmission electron microscopy image and
(c) atomic force microscopy image of exfoliated MoS2 nanosheets

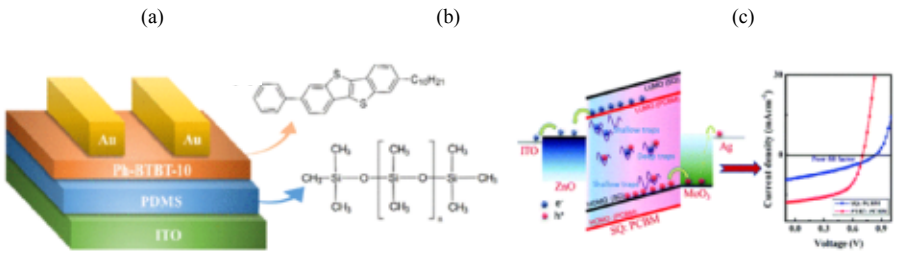


Figure 2. (a) Schematic representation of the device architecture of a bottom-gate top-contact OFET.
(b) Molecular structure of the liquid crystal, Ph-BTBT-10, and the polymer, PDMS.
(c) Schematic representation of charge carrier dynamics in SQ:PCBM bulk heterojunction solar cells

Dr. M M Shaijumon

Associate Professor

Dr. Shaijumon's group is involved in research on materials science and physics of various energy storage and conversion systems that will have huge impact on our society. The group's work is mainly focused on two areas; (i) 2-dimensional layered nanomaterials and (ii) High performance energy generation and storage systems, with a focus on experimental analyses to understand the underlying physical phenomena in these systems. Atomically thin layered transition metal dichalcogenides (TMDs) such as MoS_2, WS_2, $MoSe_2$ and WSe_2 have been emerging as the cutting edge in physics and materials science & engineering, due to their interesting electronic properties. These materials open up new opportunities for a variety of applications, including optoelectronics, energy conversion, and catalysis. To realize their potential device applications, it is highly desirable to achieve controllable growth of these layered nanomaterials, with tunable structure and morphology.

During 2020-2021, our research efforts have been focused on both energy conversion and storage studies. In one of the recent efforts, we demonstrated controllable routes to synthesize nanoparticles of tungsten oxysulfides (WO_xS_y) that exhibit enhanced electrocatalytic activity toward hydrogen evolution reaction (HER) with outstanding stability (ACS Catal. 2020, 10, 6753−6762). We further developed 0-D/2-D hybrids of phosphorene quantum dot (PQD)-interspersed few-layered MoS_2 nanosheets as efficient electrocatalysts with remarkable bifunctional electrocatalytic activity for oxygen and hydrogen evolution in an alkaline medium (Chem. Commun., 2020, 56, 8623-8626). In another recent effort, we demonstrated an efficient approach to engineer the surface active sites in β-$Co(OH)_2$ for enhanced electrocatalysis of OER (ACS Appl. Energy Mater. 2020, 3, 1461−1467).

Our recent work on energy storage devices focused more on fundamental studies on electrode kinetics and diffusion of Na ions in TiO2-based nanostructures (*ChemElectroChem* 2021, 8, 1–7).

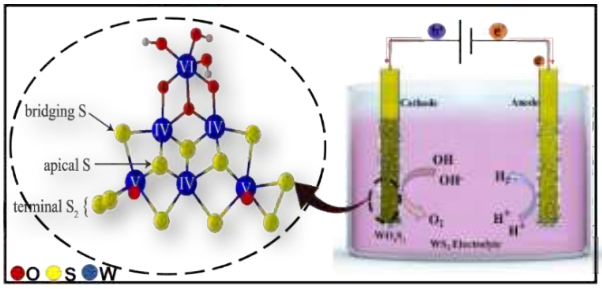


Figure 1: Schematic representation of the synthesis of WOxSy nanostructures through electrophoretic deposition. The structure of WOxSy is highlighted

Some of our on-going efforts include design and fabrication of miniaturized energy storage devices for microscale applications. Further, we are working on the CVD growth of 2-dimensional heterostructures of transition metal dichalcogenides (TMDCs).

Light-matter Sound-matter interactions:
Non-linear optics, Ultrafast process, Plasmonics & Biomedical Engineering

Dr. Ravi Pant
Assistant Professor Grade I

The nonlinear optics group is geared towards fundamental and applied aspects of nonlinear optical phenomenon in nanoscale waveguides, micro-resonators and optical fibers. The group research activities are focused towards realizing visible frequency combs in compact platforms, microwave photonics using stimulated Brillouin scattering, and nonlinear optical phenomena in the wavelength region around 2000 nm, which is emerging as the wavelength region of interest for future optical communications, gas sensing and atmospheric monitoring.

Over the last year, the group demonstrated an analogue of electromagnetically induced absorption (EIA), which is a quantum interference phenomenon, in the microwave domain. We demonstrate analogue of EIA by creating a narrow absorption window within the homogeneously broadened gain profile. The results were published in Communications Physics, volume 3, Article number: 109 (2020)). Figure 1 below shows the experimental set-up and creation of a narrow absorption window within the gain profile in the microwave domain.

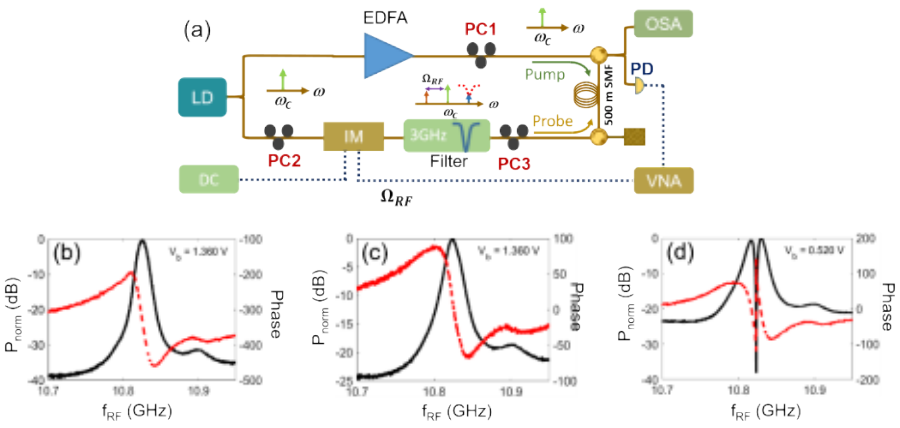


Figure 1 (a) Experimental set-up to realize an analogue of EIA in microwave domain (b)-(d) RF response showing creating of narrow absorption window within the gain profile as the polarization and bias conditions are tuned

In the area of nonlinear optical phenomena at 2000 nm, we demonstrate wavelength conversion for a single- and multi-channel signal using four-wave mixing in a single-mode fiber optimized for operation at 2000 nm. Future optical communications systems will benefit from wavelength conversion at 2000 nm, which is critical for de-multiplexing signals from a high bitrate data stream. The results were published in the IEEE Photonics Technology Letters (Volume: 32, Issue: 9, May1, Pages 542-545, 3020)). Figure 2 below shows the wavelength conversion and efficiency of conversion of a multi-channel signal.

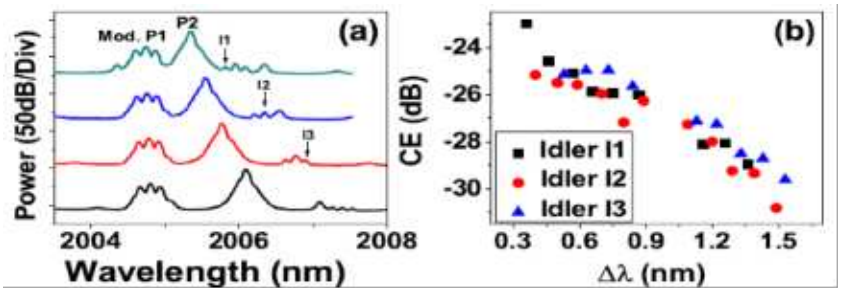


Figure 2 (a) Wavelength conversion of 3-tone signal.
(b) Efficiency of the wavelength conversion for each channel.

Dr. Joy Mitra
Associate Professor

The Scanning Probe Microscopy and Plasmonics group working under Dr Joy Mitra is primarily involved in investigating fundamental physical electronic, optical and optoelectronic phenomena realised at surfaces and interfaces, and explores avenues for harnessing the same for novel applications. In recent investigations the group has shown that photonic and plasmonic properties of meta-materials may be realised in homogeneous media like metal-oxide semiconductors (indium tin oxide, zinc oxide), even in ultra-thinfilm dimensions. Coatings of tens of nm thick ITO layers can act as perfect absorbers for wavelengths in the infrared (figure1). The observation is important since it directly impacts emissive properties of thin films and importantly their cost effectiveness.

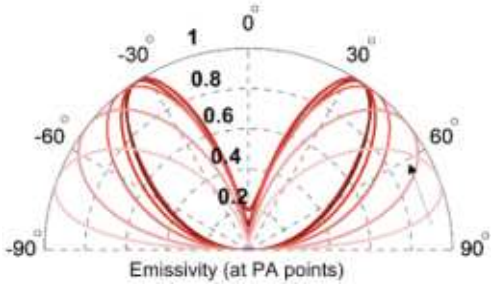


Figure 1: Angular dependence of emissivity at the respective perfect absorption points of each ITO coating of thicknesses varying from d = 20 – 400 nm on Au substrate.

Today, surface enhanced Raman spectroscopy is used for chemical fingerprinting of analytes in diverse fields ranging from detecting explosives to food contaminants. However, automation of the process, with high statistical confidence, remains a challenge due to the inherent complexity of the spectroscopy based detection methodology. Based on a novel SERS substrate, patterned on the micron scale the group has shown that optical images of the patterned substrate acquired solely with Raman scattered photons, followed by machine learning aided pattern recognition is a viable alternative to spectroscopic analysis (figure 2). The technique has higher scope of automation aiding routine applications in forensics, security, environmental monitoring, and diagnostics.

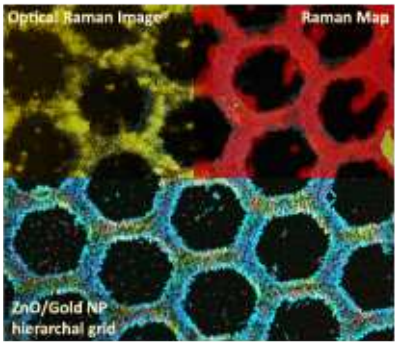


Figure 2: Composite image comprising of electron microscopy image of Au nanoparticle decorated ZnO nanorods on hexagonally patterned substrate (bottom, false colour) along with the Raman map (top right) and optical Raman image collected with Raman scattered photons (top left) with rhodamine blue coated over the substrate.

In another manifestation of investigating metal-oxide composites, the group is investigating eutectics of Ni-TiO_2 for optoelectronic applications, in collaboration with scientists from Institute of Electronic Materials Technology, Poland. The Ni nanoparticles decorating the TiO_2 backbone in the sample presents a novel platform to explore optoelectronics, catalysis, thermoelectrics and the complex plasmon – exciton landscape in these hybrid systems (figure 3).

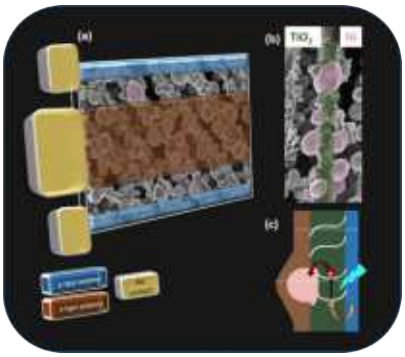


Figure 3: (a) Schematic of a photovoltaic device employing the eutectic heterostructure of Ni-TiO_2
(b) False colour SEM image of TiO_2 and Ni components.
(c) Energy band diagram of the composite showing photo-generation of carriers in TiO_S and subsequent e-h segregation

Dr. Rajeev N Kini

Associate Professor

Dr Rajeev Kini's group mainly focuses on understanding the fundamental aspects of different materials using ultrafast optical techniques like pump-probe spectroscopy, terahertz spectroscopy and time-resolved photoluminescence. The material systems of interest include two-dimensional layered materials, strongly correlated systems and artificially periodic structures. The main phenomena that have been studied in the group are (i) manipulation of the valley degrees of freedom in transition metal dichalcogenides (TMDs), (ii) the charge density wave (CDW) in the spin ladder compounds, (iii) the interaction of phonons with a two-level system in an acoustic cavity formed using superlattices and (iv) the generation & application of Terahertz electromagnetic pulses for nondestructive evaluation and testing. Recent efforts have been devoted to studying the spectroscopic signatures of CDW in the layered compound consisting of spin chains and spin ladders. Similarly, recently it was shown that light, polarized to a very high degree, could be achieved in TMD nanostructures by employing the valley degrees of freedom in TMDs. Further attempts are being made to use such TMD nanostructures for the generation of intense THz radiation. Collaborative efforts with Industry are being made to develop tools for the use of THz electromagnetic pulses for the nondestructive evaluation of thermal barrier coatings, paint layers and foams.

Dr. Mayanglambam Suheshkumar Singh

Assistant Professor Grade I

Our research group – at Biomedical Instrumentation and Imaging Laboratory (BIIL), School of Physics (SoP), IISER-TVM – focuses on study of interaction of light and/or sound with soft matter (more particularly, biological samples and soft tissues) and its exploitation for development of novel imaging modalities suitable for imaging of sample at wider range of size from biological specimens (of the order of um-mm) to clinical tissue sample (~cms). In other words, the research group focuses on design and development (instrumentation) of non-destructive (multi-dimensional) imaging system – based on optical and/or acoustic signals – for diverse applications including Biology, Chemistry, and clinical diagnosis and therapeutic treatments. The focused research areas of interest can be broadly grouped into: (1) selective plane illumination microscopy (SPIM) imaging (also know as light sheet fluorescence microscopy (LSFM)) that mainly aims to address the longstanding challenges of non-destructive and minimally invasive multi-dimensional (three or more) imaging of living and larger biological specimens for advance understanding of biological phenomena. (2) photoacoustic imaging (both microscopy and tomography) that aims to achieve microscopic resolution at imaging depth of the order of ~cms – beyond optical diffraction limit (~1-2mm).

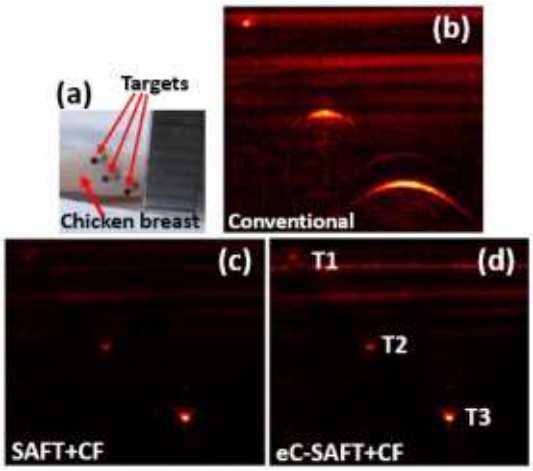


Figure 1: eC-SAFT reconstructed images of chicken tissues with graphite pencil sticks being embedded as imaging targets (in photoacoustic microscopy (PAM)).

In this year (2021), the research group focuses on development of optical microscopy imaging technology - Simultaneous Multiple-level Magnification Selective Plane Illumination Microscopy (sMx-SPIM) Imaging System - that addresses the technological challenge of obtaining images of biological specimens, at different spatial resolutions and field of views at once, in real time. The proposed technique can provide the sub microscopic features of specimens non-destructively. This promising technology has significant impact on perceiving the structural and functional complexities of a biological specimen with exceptional spatio-temporal resolutions in real-time. For photoacoustic imaging, our group focuses on computational reconstruction algorithms that holds promise for development of cost-effective PAI system using a low cost linear transducer (16 elements against 128 generally used), i.e., with this proposed algorithm, the cost of the PAI system can be sharply reduced. Again, energy compensated synthetic aperture technique (eC-SAFT) and interference correction-SAFT (iC-SAFT) reconstruction algorithms greatly improve the imaging performance of photoacoustic microscopy (PAM) in terms of depth of field (DOF), spatial resolution, SNR, and CNR. Lastly, the group successfully develops a non-invasive photo-thermal technique – with a detailed theoretical model – for enhancement of PA signal strength.

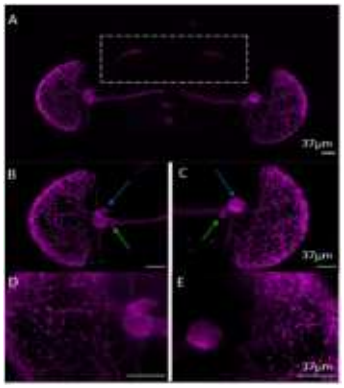


Figure 2: Dorsal view of a Drosophila melanogaster brain stained for PDF neurons imaged at (A) at 11.11X, (B) and (C) at 22.22X and, (D) and (E) at 44.44X magnifications in LSFM.microscopy (PAM)).

Prof. Anil Shaji
Professor

During 2020-21, the research work done in the group was focused on the broad areas of open quantum dynamics, non-Classical correlations in open quantum systems, quantum limited measurements and sensing and role of coherence and entanglement in molecular dynamics. The group also worked on numerical modelling of pattern formation in plants and on developing machine learning based data processing algorithms for detecting pesticide residues from surface enhanced Raman spectra of vegetable and fruit extracts placed on a custom-designed plasmonic platform.

Markovian quantum dynamics is relatively well understood in the theory of open quantum systems while a good understanding and mathematical description of non-Markovian dynamics is still not available. We showed that convex combinations of Markovian, completely-positive dynamics can lead to non-Markovian evolution paving the way for research into the possibility of unravelling all non-Markovian dynamics into convex combinations of specific Markovian or even unitary dynamics. On a related note, some of the quantum master equations that describe open dynamics are known to have singular behavior. We were able to show that constructing higher order master equations one can avoid the singular behavior.

An experimentally implementable two-photon system was studied in detail by us with the aim of using it as a test-bed for open dynamics. Specifically the frequency degrees of freedom of the photons is treated as the environment while the polarization of the photons is treated as the system of interest. The interaction between the two is a frequency dependent rotation of the polarization that can be engineered in the lab. Corresponding to various initial distributions of the photonic frequencies, we found that different kinds of open quantum dynamics can be generated for the polarization degree of freedom.

Identifying the resources that make mixed state quantum computing possible was another line of research taken up by the group. We found that in many structured quantum systems made of many qubits, the global entanglement in the states of these systems are connected to the non-classical correlations present in small subsystems made of one or two qubits. This indicated that the mixed states in quantum information processors may be able to harness the computational power of the larger pure state that it is part of in some cases to provide computational advantage.

We developed a mathematical model for a linear molecule coupled strongly to a cavity electromagnetic field that was able to model accurately observable spectroscopic quantities for the experimental system. The group also worked on modeling the process of healing of wounds in plants; specifically in the leaves. The model was able to explain the observations that came from a sequence of controlled experiments that involved creating wounds of various sizes in the growing leaves of plants.

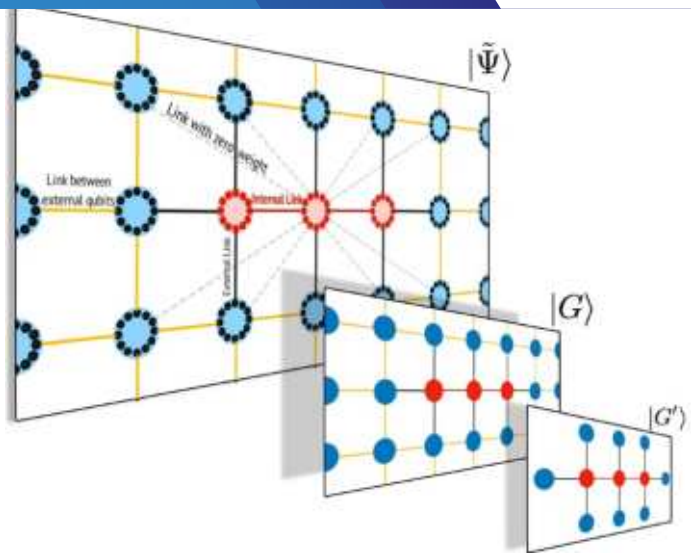


Figure 1: A structured multi-qubit system in which a connection between the global entanglement and non-Classical correlations in its subsystems can be established

Dr Manik Banik
Assistant Professor Grade I

Brief description of research: My research during the above mentioned period is mainly focused on problems related to quantum foundations and quantum information with an aim to find useful applications in emerging field of quantum communication and quantum internet.

Nonlocality, one of the most puzzling features of multipartite quantum correlation, has been identified as a useful resource for device-independent quantum information processing. While bipartite no-signaling correlations allow a dichotomous classification - local vs nonlocal, in a multipartite scenario the authors show the existence of several types of nonlocality that are inequivalent under the proposed operational framework. In a recent Editor's suggestion, we propose a finer characterization of multipartite no-signalling correlations based on an operational framework [Phys. Rev. A 102, 052218 (2020) (Editors' Suggestion)].

Quantum correlations provide dramatic advantage over the corresponding classical resources in several communication tasks. However, a broad class of probabilistic theories exists that attributes greater success than quantum theory in many of these tasks by allowing supra-quantum correlations in "space-like" and/or "time-like" paradigms. In a recent letter, we propose a communication task involving three spatially separated parties where one party (verifier) aims to verify whether the bit strings possessed by the other two parties (terminals) are equal or not [Annalen der Physik 532, 2000334 (2020) (Rapid Research Letter)]. Manifestly, classical resources are not sufficient for perfect success of this task. Moreover, it is also not possible to perform this task with certainty in several non-classical theories although they might possess stronger "space-like" and/or "time-like" correlations. Surprisingly, we show that quantum resources can achieve the perfect winning strategy.

Quantum mechanics is compatible with scenarios where the relative order between two events can be indefinite. In a recent work, we show that two independent instances of a noisy process can behave as a perfect quantum communication channel when used in a coherent superposition of two alternative orders [New J. Phys. 23, 033039 (2021)]. This phenomenon occurs even if the original process has zero capacity to transmit quantum information. In contrast, perfect quantum communication does not occur when the message is sent directly from the sender to the receiver through a superposition of alternative paths, with an independent noise process acting on each path. The possibility of perfect quantum communication through independent noisy channels highlights a fundamental difference between the superposition of orders in time and the superposition of paths in space.

Non-Equilibrium Systems: Quantum Field Theory, Complex systems, Non-Linear Dynamics & Fluid Dynamics

Dr Sreedhar B Dutta

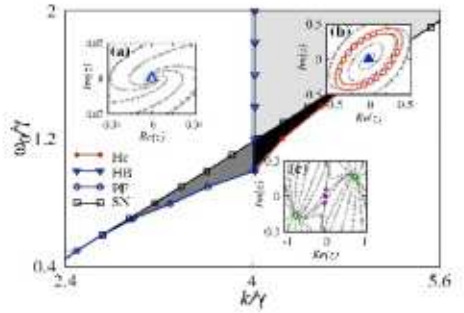
Assistant Professor Grade I

The main emphasis of Sreedhar Dutta's research group is on topics in Nonequilibrium Physics and Effective Field Theories. Some of the major goals currently pursued by the group is towards establishing appropriate framework to describe periodically driven macroscopic systems and to investigate thermodynamics of such systems. Motivated to understand the asymptotic behavior of periodically driven thermodynamic systems, some of the members of the group have studied the prototypical example of Brownian particle, overdamped and underdamped, in harmonic potentials subjected to periodic driving. They have obtained the asymptotic distributions almost exactly treating driving nonperturbatively by exploiting an underlying symmetry, and have studied the dynamics and fluctuations of energies and entropy. They have further obtained various correlation functions and investigated the responses to drift and diffusion perturbations in the presence of driving. This work, done by Shakul Awasthi and Sreedhar Dutta, has been reported in Physical Reviews E 101, 042106 (2020). In addition, Rajiv Pereira, one of the PhD students of the group, has investigated anisotropic properties of the critical dynamics of a genuine nonequilibrium system and evaluated various nonequilibrium critical exponents using renormalization group techniques, and reported the work in Physical Review E 102, 062150 (2020).

Dr D. V. Senthilkumar

Assistant Professor Grade I

Nonlinear Dynamics group, lead by Dr. D. V. Senthilkumar, is currently working on the emerging dynamics of complex networks with various topologies and their relevance to real world phenomena. In particular, recent focus is on chimera states, a hybrid state with coexisting coherent and incoherent domains emerging from an ensemble of identical nonlinear oscillators by adopting various network topologies and models. Recently, his group is also working on enhancing the robustness of coupled oscillator networks despite the presence of a large fraction of local deterioration/failures in node dynamics by framing alternate mechanisms. For instance, his group introduced a simple limiting factor in the diffusive coupling, processing delay and adaptive coupling in terms of low-pass filters to improve the robustness of the macroscopic dynamics of the coupled oscillator networks. Nonlinear dynamics group is also working on the prey-predator interactions to understand the persistence and extinction of the ecological communities under global environmental change and to come up with strategies to improve the persistence of the ecological communities.



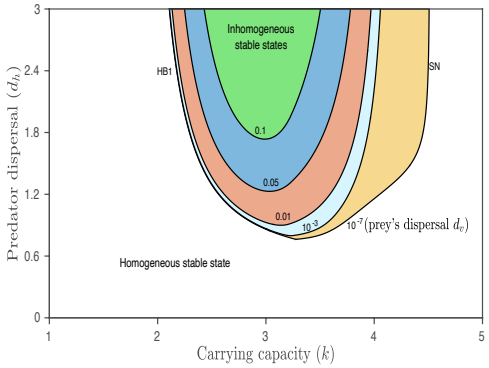


Figure 1: Phase diagram of population of pulse coupled Winfree model depicting synchronous and asynchronous states.
Figure 2: Phase diagram of two-patch predator-prey metacommunity model illustrating homogeneous and inhomogeneous stable states for various prey's dispersal rate elucidating that the predator dispersal increases the metacommunity persistence, whereas the prey dispersal reduces it.

Awards and honors: Alexander von Humboldt Fellow.

High Energy Physics, Astronomy & Astrophysics:
Cosmology, Particle Physics, String Theory & Gravitational waves

Dr Bindusar Sahoo
Associate Professor

Publication:

Curvature squared action in four dimensional N=2 supergravity using the dilaton Weyl multiplet, Madhu Mishra and Bindusar Sahoo, JHEP 04 (2021) 027, arxiv:2012.03760. In this paper we have constructed the supersymmetrization of arbitrary curvature squared terms coupled to an arbitrary number of vector multiplets in N = 2 Poincare supergravity. We used the dilaton Weyl multiplet for our purpose. It is fairly well known from the work of Bergshoeff, de Roo and de Wit [Nucl. Phys. B 182 (1981) 173–204] that if one starts with the chiral background constructed out of the standard Weyl multiplet and uses the chiral density formula then one gets the supersymmetrization of pure Weyl tensor square term. One can couple arbitrary number of vector multiplets with this chiral background and upon using one of the vector multiplet as a compensator for Poincare gauge fixing, one obtains the supersymmetrization of Weyl square term coupled to an arbitrary number of vector multiplets in N = 2 Poincare supergravity. Since the standard Weyl multiplet and the dilaton Weyl multiplet are related via a mapping, one expects this construction to go through for the dilaton Weyl multiplet. The dilaton Weyl multiplet has the advantage that one can construct supersymmetrization of Riemann tensor square term in Poincare supergravity. This is because, upon Poincare gauge fixing, there exists a mapping between a Yang-Mills multiplet and the dilaton Weyl multiplet. On the other hand one can construct an action for the Yang-Mills multiplet in four dimensions via embedding it in a chiral multiplet and using the chiral density formula. Further, the mapping between the Yang-Mills multiplet and the dilaton Weyl multiplet allows us to construct supersymmetrization of pure Riemann square term in N = 2 Poincar´e supergravity. In order to construct supersymmetrization of Ricci scalar square term, one can use the tensor multiplet and its embedding into a reduced chiral multiplet. This allowed us to construct supersymmetrization of arbitrary curvature squared terms coupled to an arbitrary number of vector multiplets and the entire action is encoded in a single prepotential. This work has been carried out in collaboration with Ms. Madhu Mishra who is a PhD student at IISER Thiruvananthapuram.

Dr Tanumoy Mandal

Assistant Professor Grade I

Topic-1

We have identified the subset of leptoquark (LQ) models that are motivated from the flavor sectors and obtained the regions of various LQ model parameters that can accommodate the flavor anomalies. We have estimated exclusion limits on the various LQ models by recasting the existing dilepton and monolepton plus missing energy resonance search data from the LHC. In this, the contributions from interference effects, pair and single productions were systematically incorporated. Various flavor anomalies suggest that LQs couple more strongly to the third generation than the first two generations. The LHC search strategies for those LQs that couple dominantly to a top quark are different from the ones that couple mostly to the light quarks. For example, LQs that decay to top quarks can produce boosted tops that can be detected with high efficiency using jet-substructure methods. We have obtained the HL-LHC prospects of all scalar and vector LQs that couple to a top quark and a lepton of any generation.

Papers:

1) Boosting vector leptoquark searches with boosted tops. PRD, 101, 115015 (2020)
2) Precise limits on the charge-2/3 U1 vector leptoquark. Under review in PRD.

Topic-2

We have written down the simplified model Lagrangian terms with the top-partners and the Higgs partners. We have identified the important yet unexplored search channels in those models. We have estimated exclusion limits on different models by recasting the existing vectorlike quark search results and other relevant searches with similar final states. We analyzed various symmetric and asymmetric final states arising from the pair and the single production channels using modern techniques like jet-substructure, multivariate analysis etc. Our aim was to improve the existing vectorlike top-partner searches using the combined pair and single productions. and estimate the projected high-luminosity LHC discovery reach and exclusion limits of the model parameters like masses and couplings.

Papers:

Signatures of vectorlike top partners decaying into new neutral scalar or pseudoscalar bosons. JHEP, 05, 028 (2020).

Topic-3

An anomaly-free U (1) extension with three RHNs is considered where the tiny neutrino masses are generated through the Froggatt-Nielsen mechanism with higher-dimensional operators. We have explored the neutrino sector, collider aspects of this model. We also showed that the lightest RHN could be a dark matter candidate. We have investigated the possibility of the leptogenesis mechanism in this model.

Papers:

Neutrino and Z' phenomenology in an anomaly-free U(1) extension: role of higher-dimensional operators. JHEP, 06, 111(2020).

Dr Soumen Basak

Associate Professor

Dr Soumen Basak's group primarily focuses on the estimation of source parameters from Massive Black Hole Binary (MBHB) signals. These signals are expected to be observed by Laser Interferometer Space Antenna (LISA), a space-based Gravitational Waves detector. Our first step in this journey was to take part in the LISA Data Challenges (LDC), particularly the ones related to the MBHBs. We were successful in completing this challenge. As our experience grew, we decided to tackle more difficult problems. One of the most challenging issues in LISA data collection and analysis are the data gaps. These are periods of time when the instruments onboard the spacecraft will not be functioning properly, either due to scheduled maintenance (scheduled gaps) or due to unforeseen issues that hamper the optimal operation of the instruments (unscheduled gaps). Using state-of-art models for astrophysical catalogs of MBHBs merging within LISA lifetime, we investigated this issue in detail (https://arxiv.org/abs/2104.12646). We followed this up with the calculation of Fisher Information Matrices (FIM) to investigate the effect of gaps on parameter estimation. We showed that, depending on the GW signal; parameter estimation is possible using Bayesian inference even if gaps cover up a major part of the signal.

The group also focuses on the measurement of mass and radius stars. These measurements are important inputs for the models of stellar structure. Binary stars are of particular interest in this regard, because astrometry and spectroscopy of a binary together provide the masses of both stars as well as the distance to the system, while interferometry can both improve the astrometry and measure the radii of the stars. We demonstrated by simulation parameter recovery from intensity interferometry, especially the challenge of disentangling the radii of two stars from their combined interferometry signal (https://arxiv.org/abs/2105.09532). Measurement of angular radii, angular separation and first-order limb darkening appears readily achievable for bright binary stars with current.

Apart from these work, the group is involved in statistical study of the publicly available high quality cosmological data sets. We carried out a rigorous test of E-mode polarization of the Cosmic Microwave Background (CMB) radiation observed by the Planck satellite using two complementary methods, namely, the Contour Minkowski Tensor (CMT) and the Directional statistic (D-statistic). We compared the results obtained using these statistics from the observed Planck data with those obtained from isotropic simulations of sky having the same power spectrums (https://doi.org/10.1103/-PhysRevD.103.123523). We found no statistically significant deviation from statistical isotropy of E-mode of CMB measured by Planck.

Dr. Mathew Arun Thomas
(Inspire Faculty)

In the year 2021 I have been mostly focused on the extra dimensional and Effective Field theory approach to flavour physics.

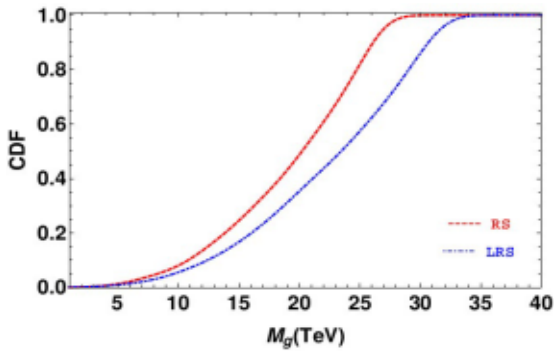


Figure 1: Cumulative Distribution Function for Mg from εK (analysis performed from the dominant |ImCsd| Wilson coefficient) for Randall Sundrum(RS) and Little RS model. Dashed lines correspond to the RS and dash-dot to LRS

In my work (submitted to Physical Review D), we had seen that the Randall Sundrum (RS) models receive significant constraints from the neutral Kaon system. The CP violating observable, in Randall Sundrum scenario, requires the lightest KK gluon to be heavier than ~ 24 TeV. The constraint is even stronger in the Little Randall Sundrum models (LRS) as shown in Fig 1. On the other hand, Little RS models are motivated for their possible visibility at the Large Hadron Collider (LHC). In the paper we showed that the stringent constraints from K-physics can be relaxed in the Little RS models, in the presence of the Brane Localised Kinetic Terms (BLKT). In particular, for a range of values, a UV BLKT could significantly modify the lightest KK gluon wave function such that the limit can be reduced to 5 TeV as shown in Fig 2. We also showed that such a relaxation of the constraints can also be achieved by imposing flavour symmetry via Minimal Flavour Protection as shown in Fig 3.

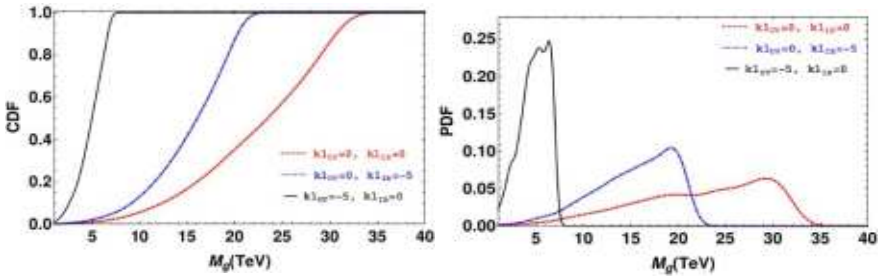


Figure 2: Cumulative distribution function and Probability distribution function satisfying the constraint on Im(C4) Wilson coefficient for three different scenarios of Brane Localized Kinetic Terms: (a) klIR = klUV = 0 (red dash) (b) klUV = 0,klIR = −5.0 (blue dot-dash)(c) klIR = 0,klUV = −5.(black solid)

Also, we have been studying the flavour violating pion decays to understand the Low energy Effective Field Theory operators (LEFT) that get involved in the process.

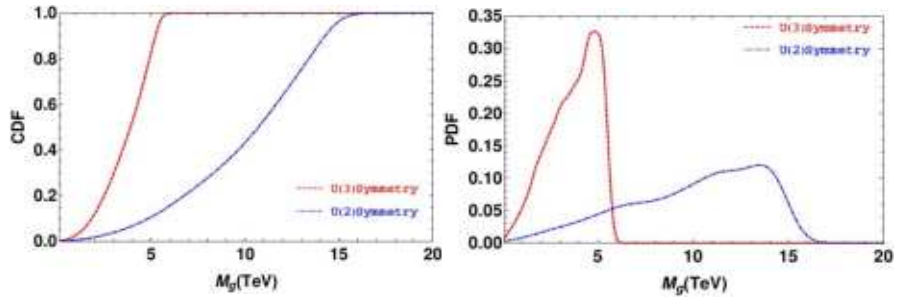
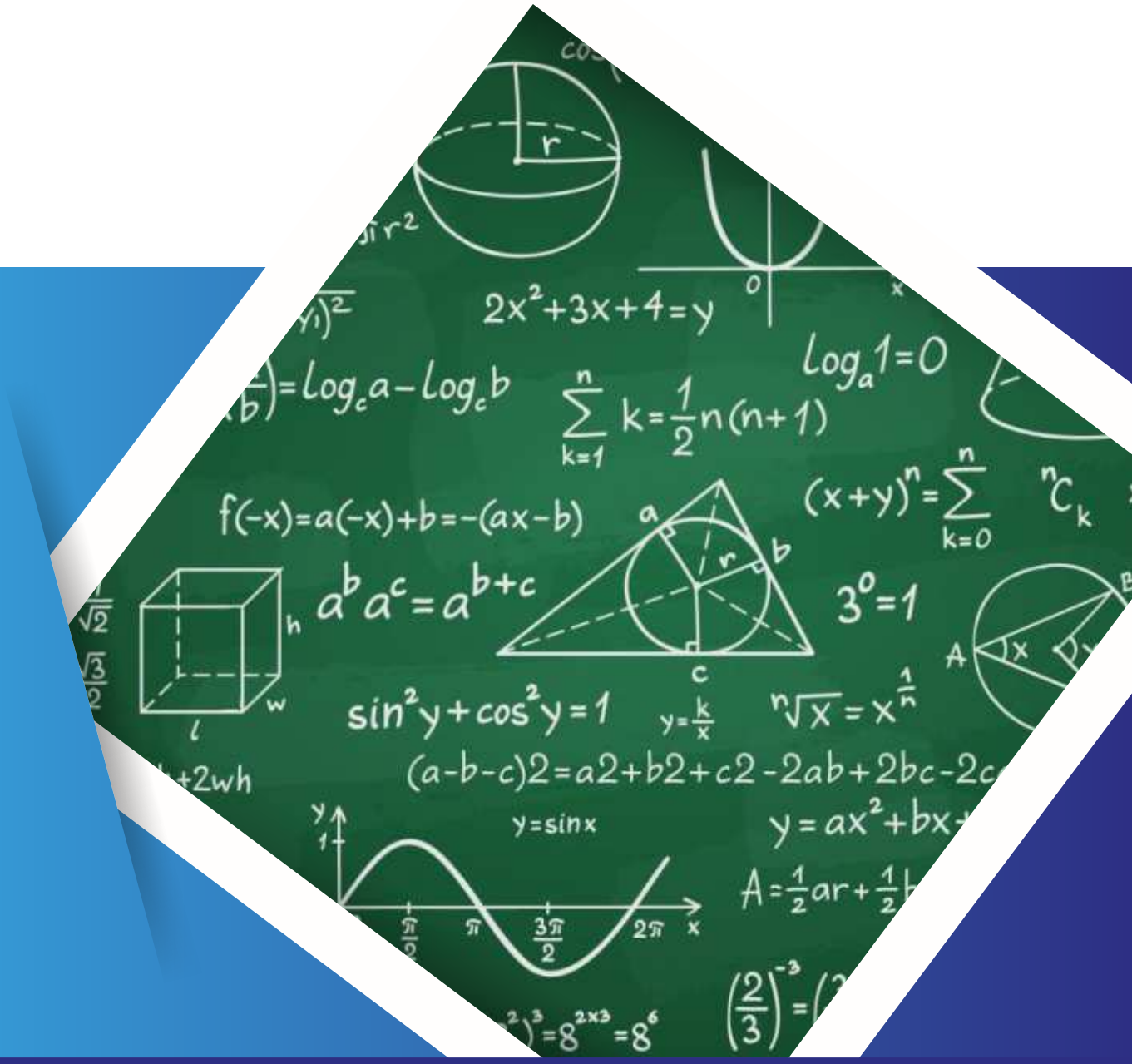


Figure 3: Cumulative distribution function and Probability distribution function regions satisfying the constraint on Im(C1) Wilson coefficient (for the cases of Unbroken U(3) flavour symmetry (red dashed)), and Im(C4) Wilson coefficient (for the cases of Unbroken U(2) flavor symmetry (blue dot-dash)) as a function of Mg.

Here, we consider the flavor violating low energy effective operators and compute their non-perturbative (via Chiral PT expansion) contribution of scalar and vector operators in process. We observe that the scalar operator contributes heavily to the flavour violating pion decay and this puts the strongest constraint on the scalar Wilson coefficients. Also, this prompts us to look for New Physics (NP) that satisfy such constraints. NP models, that are UV motivated, should only lead to the Standard Model Effective Field theory operators (SMEFT). This is because at the NP mass scale the Z and W bosons along with the Higgs field are dynamical and cannot be integrated out. After doing a Renormalization Group running of these SMEFT coefficients to 2 GeV, we are now adept to match the LEFT operators with the SMEFT ones at 1 loop. Using an educated guess, from high energy collision experiments which probes NP directly, that such models couple only via the third generation fermions, this readily gives us a parameter space for these SMEFT operators that is heavily constrained. Much more than the allowed parameter space from the data collected at LHC 1, 2 runs and LEP put together.



SCHOOL OF MATHEMATICS

Algebra and Number Theory

Dr.Viji Z Thomas

Associate Professor

Dr Viji Z Thomas works in Group theory, Homological algebra and Commutative algebra. For the past couple of years he has been working on Schur's exponent conjecture which states that for a finite group, the exponent of the Schur multiplier divides the exponent of the group. Along with his PhD students, he has shown that the conjecture is true in p groups of class at most p, p groups of class at most 5. Moreover using their approach they have been able to prove most of the results obtained towards this conjecture in the last 70 years. Presently they are trying to see if the problem holds true for metabelian p groups.

Publications:

A property of p- groups of nilpotency class p+1 related to a theorem of Schur, A. E. Antony, P. Komma, V. Z. Thomas, to Appear in Israel Journal of Mathematics

Funding:

Matrics, DST-SERB Grant.

PhD students Graduated:

1) Ammu. E Antony, graduated in 2020, and presently a post doc at University of Haifa and Technion, Israel.

Dr. Srilakshmi K

Assistant Professor Grade I

In a joint work with Mr. Sunil Kumar, Dr. Srilakshmi studied the p-divisibility of class numbers of an infinite family of certain imaginary quadratic fields. This work is published. NOTE ON THE p-DIVISIBILITY OF CLASS NUMBERS OF AN INFINITE FAMILY OF IMAGINARY QUADRATIC FIELDS Glasgow Mathematical Journal, 1-6, 2021. In another joint work with Dr. Kathiravan and Mr. Abinash Sarma, Dr. Srilakshmi is working on the vanishing of coefficients of η^26.

In another Joint work with Mr. Sunil Kumar, Dr. Srilakshmi studied the connection between Euclidean ideals and class groups when the class group is cyclic.

Dr. Sachindranath Jayaraman

Associate Professor

Dr. Sachindranath Jayaraman's research interests are in Linear Algebra and Matrix Analysis. His recent research concerns the following non-overlapping themes: (1) Linear preservers of certain positivity classes of matrices and (2) Linear Algebra and Dynamical Systems.

A brief explanation of work done :
Linear preserver problems has a rich history within linear algebra/matrix analysis as well as other
a property or a relation . There are two types of preservers one encounters: (1) when L( ) = - branches of mathematics. A linear preserver is a linear map L on a space of matrices that preserves these are called strong/onto preservers and are often tractable, and (2) when L( ) - these are called into preservers and are usually subtle and challenging. Current interest in this area involves preserver properties of certain positivity classes of matrices such as copositive and completely positive matrices as well as other related matrix classes. This is a joint work with my former PhD student Dr. Vatsalkumar (a visiting fellow at the Indian Statistical Institute) and Dr. Chandrashekaran of the Central University of Tamilnadu. Preserver problems involving positivity classes of matrices is an extremely challenging question and pose several intriguing questions, as techniques over the real field are very different from the complex case. I wish to highlight that in a recent work that was published in the Electronic Journal of Linear Algebra, Vatsalkumar and I resolved a conjecture on linear preservers of a well-known positivity class of matrices arising in the optimization literature, namely, semipositive matrices.

An interesting consequence of the Perron-Frobenius theorem discusses the existence of periodic points of a nonnegative matrix. In a recent communicated work, jointly done with Dr. Shrihari Sridharan and our joint student Mr. Yogesh Prajapaty, a generalization of the above result for products of nonnegative matrices corresponding to words (possibly of infinite length) coming from a finite collection of nonnegative matrices was obtained. The existence of common periodic points for the collection as well as connections to random dynamics are worth mentioning. A key ingredient in the work described in the previous paragraph is the existence of common eigenvectors for the collection, which is a non-trivial problem when the matrices do not commute. In addition, we have also obtained an interesting analogue of our result for appropriate sub-homogeneous maps that arises in nonlinear Perron-Frobenius theory. This work is under review in a reputed journal. Possible extensions of these to the max algebra setting over the nonnegative real numbers is being investigated.

Besides the above, I am interested in other preserver problems as well as problems on matrix poly- nomials. Some of these may possibly be taken up by prospective PhD students.

Publications during the period April 2020-March 2021 References

1) S. Jayaraman, Y. K. Prajapaty and S. Sridharan, Dynamics of products of nonnegative matri- ces, communicated (https:arxiv.org/abs/2010.05560).
2) S. Jayaraman and V. N. Mer, On linear preservers of semipositive matrices, Electronic Journal of Linear Algebra, 37 (2021), 88-112.
3) J. Das, S. Jayaraman and S. Mohanty, Distance matrix of a class of completely positive graphs: determinant and inverse, Special Matrices, 8 (2020), 160-171.

Research Area:
Linear Algebra and Matrix Analysis

Students:
Vatsalkumar N. Mer, PhD student, thesis submitted in December 2019, defended in April/May 2020. Currently a visiting fellow at the Indian Statistical Institute, New Delhi.

Publications:
3 (two in Electronic Journal of Linear Algebra, 1 in Indian Journal of Pure and Applied Mathematics).

Dr. Geetha T
Assistant Professor Grade I

In a joint work with my student Amrutha P, we studied the determinants of the generalised symmetric groups G(n,r). We gave an explicit formula to compute the determinant of an irreducible representation of the generalised symmetric group and for given an integer n and an odd prime r and a non-trivial character of G(n,r), we gave a closed formula to compute the number of irreducible representations of G(n,r) whose determinant is the given character. This work generalises a work appeared in combinatorial theory series A by Prof. Amritanshu Prasad, Prof. Arvind Ayyer and Prof. Steven Spallone and another work appeared in Journal of Algebraic combinatorics by Prof. Steven Spallone and Dr.Debruan Gosh and is under review.

In ongoing work with Amrutha P, we are studying the generic semisimplicity of the A-Brauer algebras. A-Brauer algebras are the generalisation of the Brauer algebras and the cyclotomic Brauer algebras which are already well studied in the literature and by establishing the generic semisimplicity of A-Brauer we can thus produce a uniform way of understanding the structure of these algebras in the split semi semisimple case. This is yet to be communicated.

In another joint work with my student Amrutha P, we are studying the number of irreducible representations of Symmetric group, Hyper-octahedral group, Generalised symmetric group and Alternating group whose degree is coprime to some positive power of 2. In this work we aimed at a recursive formula for some groups and a closed formula to count the number for the remaining groups mentioned above and this is an ongoing work.

Dr. Sarbeswar pal
Assistant Professor Grade I

Let (X, H) be a polarized smooth projective algebraic surface and E is globally generated, stable vector bundle on X. Then the Syzygy bundle M_E associated to it is defined as the kernel bundle corresponding to the evaluation map. In this project we have studied the stability property of M_E with respect to H.

Analysis

Dr. Shrihari Sridharan
Associate Professor

Last year, Dr. Shrihari Sridharan furthered his study of the dependence of Lyapunov exponents of polynomials on their coefficients (with his graduate student Atma Ram Tiwari). The same was published in Advanced in Dynamical Systems and Applications. He also studied about the distribution of typical orbits for a skew-product map generated by random dynamics of finitely many rational maps (with his students Sharvari Neetin Tikekar and Atma Ram Tiwari). This was published in Complex Analysis and Operator Theory.

Dr. Devaraj
Associate Professor

Dr. Devaraj's research during the last year deals with the analysis of certain convolution operators on locally compact abelian groups. He has obtained reconstruction formula for local averages In one of his works with his Ph.D student, he has analyzed the local average sampling problem over Shift invariant subspaces of L^2(G). They have established certain sampling expansions over functions on locally compact abelian groups.

Prof. Utpal Manna

Professor

Prof. Utpal Manna works in the areas of stochastic (geometric) partial differential equations with applications to problems arising from fluid dynamics, magnetisation, nematic liquid crystals and other physical models and study their existence, uniqueness, regularity and various statistical properties of solutions.

Weak Solutions and invariant measures of stochastic Oldroyd-B type model driven by jump noise, Utpal Manna and Debopriya Mukherjee, Journal of Differential Equations, Vol. 272 (25), pages 760-818, 2021.

Dr. Sheetal Dharmatti

Assistant Professor Grade I

Dr. Sheetal Dharmatti's work is based on optimal control of the Cahn Hilliard system coupled with dynamics equations like Navier Stokes' equation(CHNS), Brinkman (CHB) equations etc. The main theme of these works is to prove the existence of optimal control for a suitable control problem subjected to given equations. The following three papers based on these works have got published in the last year.

Using dynamic programming principle, corresponding cost functional is shown to be the unique viscosity solution of the corresponding Hamilton Jacobi equation. This is a first work which uses viscosity solution theory to study optimal control associated with coupled nonlinear systems. This work has been communicated and further works on such coupled systems is initiated.

1. Tania Biswas, Sheetal Dharmatti, P L N Mahendranath and Manil T Mohan, On the Stationary Nonlocal Cahn Hilliard Navier Stokes System: Existence, Uniqueness and Exponential Stabilization Accepted for publication in Asymptotic Analysis.

2. Sheetal Dharmatti and P L N Mahendranath, Nonlocal Cahn-Hilliard-Brinkman System with regular potential: Regularity and optimal control, Journal of Control and Dynamical Systems
, 27(2021) no 2 221-246

3. Tania Biswas, Sheetal Dharmatti and Manil T Mohan, Second Order Optimality Conditions for Optimal Control Problems Governed by 2D Nonlocal Cahn Hilliard Navier Stokes Equation, Nonlinear Studies , 28, (2021) no 1 29-43
Another area of interest of Dr. Dharmatti is Image Processing. A work with a passed out MS student and a collaborators from Clarkson's university on image processing was accepted for publication in the journal Signal, Image and Video processing.

4. Prashant Athavale, Soumyabrata Dey, Sheetal Dharmatti and Aiswarya Sara Mathew, A novel entropy-based texture inpainting algorithm, Signal, Image and Video processing 2021 (published online on 19 January 2021)

Dr. Dhanya Rajendran
Assistant Professor Grade I

Dr. Dhanya has been working on semilinear elliptic problems with the indefinite nonlinearities. Recently, along with collaborators she is working on the fractional p-Laplace problem with superlinear growth. She is also interested in the comparison principle for p Laplacian and multiplicity of positive solutions for quasilinear elliptic PDE's.

Applicable Mathematics

Dr. K. R Arun
Assistant Professor Grade I

Analysis of an Asymptotic Preserving Low Mach Number Accurate IMEX-RK Scheme for the Wave Equation System (Jointly with A. Das Gupta and S. Samantaray; To appear in Appl. Math. Comput.)

In this paper the analysis of an asymptotic preserving (AP) IMEX-RK finite volume scheme for the wave equation system in the zero Mach number limit is presented. An IMEX-RK methodology is employed to obtain a time semi-discrete scheme, and a space-time fully-discrete scheme is derived by using standard finite volume techniques. The existence of a unique numerical solution, its uniform stability with respect to the Mach number, and the accuracy at low Mach numbers are established for both time semi-discrete and space-time fully-discrete schemes. The AP property of the scheme is proved for a general class of IMEX schemes which need not be globally stiffly accurate. Extensive numerical case studies confirm uniform second order convergence of the scheme with respect to the Mach number and all the above-mentioned properties.

A Unified Asymptotic Preserving and Well-balanced Scheme for the Euler System with Multiscale Relaxation (Jointly with M. Krishnan and S. Samantaray; Under review)

The design and analysis of a unified asymptotic preserving (AP) and well-balanced scheme for the Euler Equations with gravitational and frictional source terms is presented in this paper. The asymptotic behaviour of the Euler system in the limit of zero Mach and Froude numbers, and large friction is characterised by an additional scaling parameter. Depending on the values of this parameter, the Euler system relaxes towards a hyperbolic or a parabolic limit equation.

Standard Implicit-Explicit Runge-Kutta schemes are incapable of switching between these asymptotic regimes. We propose a time semi-discretisation to obtain a unified scheme which is AP for the two different limits. A further reformulation of the semi-implicit scheme can be recast as a fully-explicit method in which the mass update contains both hyperbolic and parabolic fluxes. A space-time fully-discrete scheme is derived using a finite volume framework. A hydrostatic reconstruction strategy, an upwinding of the sources at the interfaces, and a careful choice of the central discretisation of the parabolic fluxes are used to achieve the well-balancing property for hydrostatic steady states. Results of several numerical case studies are presented to substantiate the theoretical claims and to verify the robustness of the scheme.

WENO Smoothness Indicator Based Troubled-cell Indicator for Hyperboic Conservation Laws (Jointly with A. K. Dond and R. Kumar; In preparation)

Hybrid algorithms are an efficient and popular choice for computing the solution of hyperbolic conservation laws. In general, hybrid algorithms involve low-cost higher-order accurate schemes in the smooth regions and non-oscillatory shock-capturing schemes in the troubled cells. The troubled-cell indicator plays a significant role in the efficiency of the hybrid algorithms. This article proposed a new troubled-cell indicator utilising the smoothness indicator of WENO schemes for hyperbolic conservation laws. Using the new troubled-cell indicator, we have proposed three hybrid algorithms independent of order and WENO schemes. For demonstration, we have considered 5th and 7th order WENO-Z reconstruction. The first two algorithms retain the accuracy and resolution of solution across discontinuities of the WENO scheme in less computational cost. At the same time, the third algorithm ensures the convergence of the scheme in the case of hyperbolic conservation laws with non-convex flux, where WENO schemes converge to non-entropy solutions.

Student Placement

- Saurav Samantaray defended his PhD thesis in December 2020 and is currently a postdoctoral fellow in University of Notre-Dame, Indiana, USA.
- Vidya V. Babu, BS-MS student of batch 2015, is applying for PhD positions.
- Meenakshi Krishnan, BS-MS student of batch 2016, has secured PhD position in University of Maryland, Maryland, USA.
- H. Rohin, BS-MS student of batch 2016, has secured PhD position in University of Texas at Dallas, Texas, USA.

Dr. Sudarshan Kumar

Assistant Professor Grade I

Dr. Sudarshan Kumar's broad area of research is numerical analysis and computational methods for non-linear system of hyperbolic conservation law and he is currently focussing on developing and analysing class of high-order numerical methods for the hyperbolic conservation laws. Flux reconstruction schemes for these set of partial differential equations is an active research topic in this area. Dr. Sudarshan has started a collaboration with Prof. Praveen of TIFR CAM Bengaluru and worked on developing a new class of Lax-Wendroff flux reconstruction schemes, which posses several advantages and highly efficient, in particular when applied to Euler equations.

Prof. M.P. Rajan

Professor

My research group focuses on numerical Functional Analysis of PDEs, mathematical finance, mathematical biology, and machine learning and data science. My current Ph.D students are working on on solving inverse and ill-posed problems. The idea is to get stable approximate solution for problems that are ill-posed in nature. Also, our group deeply involved in data science research that is an interdisciplinary field that make use of mathematics, statistics and computer science applicable to various domain such as Banking, Financial Services and Insurance (BFSI), Health Care, Genetics and many scientific areas. Data plays a big role in the modern digital world. Machine Learning and Artificial Intelligence are modern techniques used to discover hidden truth behind the data. The research focus upon developing new algorithms in this direction.

Dr. Nagaiah Chamakuri
Assistant Professor Grade I

My current research group (Scientific Computing Group) focuses on numerical analysis and scientific computing, optimal control of partial differential equations, and computational cardiology. Recently, we proposed a novel memory-efficient coupled solver for the solution of the system of reaction-diffusion equations that arises in cardiac electrophysiology. The proposed method outperformed well qualitatively compared with existing operator splitting approaches. The specific application in this direction is to develop a computational model based on the bidomain model to investigate the theoretical relationship between aspects of the field potential (FPs) and the underlying cardiac action potential (AP) is very useful. In this regard, develop the computational technologies for computing the FPs corresponding to the early after-depolarizations (EADs) which will provide some important insights on life-threatening cardiac arrhythmias during the drug screening process in safety pharmacology. Moreover, one of the main focuses of our group is to develop an optimal control framework for cardiac defibrillation. Calcium is a critical regulator of heart function. Cardiac ryhthmicity and contractility critically result from tightly regulated calcium fluxes in cardiomyocytes. Calcium is the main source between the electrical signals that pervade the heart and contraction of the myocytes to propel blood. This is a joint work from Prof. Martin Falcke(MC Berlin, Germany) and Prof. Johann Schredelsekhar (LMU, Munich, Germany). In our joint work, we will apply a combined experimental and modelling approach to investigate the role of mitochondria on calcium handling of a human cardiomyocyte. Our group mainly involves in developing an efficient simulation toolbox for the spatially detailed Ca2+ dynamics and the cardiomyocyte membrane potential interaction in cardiac electrophysiology.

Projects:

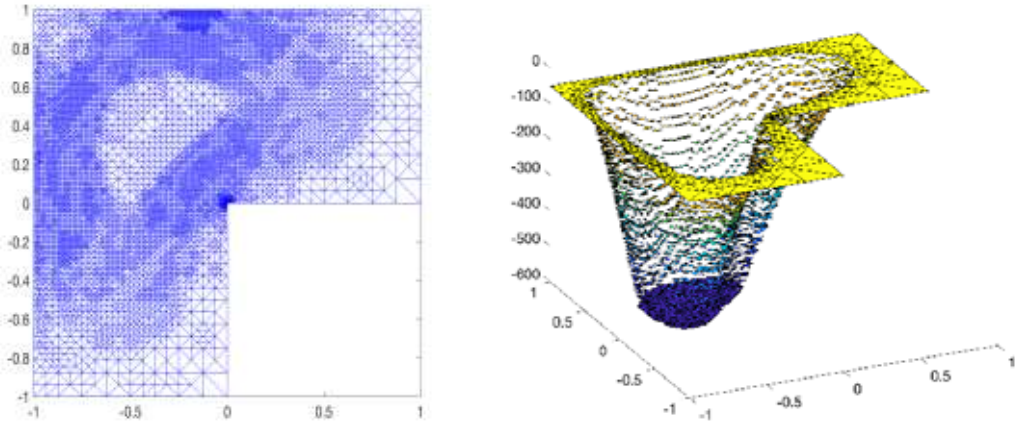
Our group bagged the National Supercomputer Mission (jointly with DST-MeITy) project.
The project title "HPC technologies and large scale simulations of the electromechanical for the heart function"

Major project students

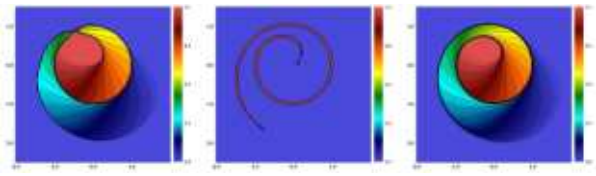
Mr. Nilesh Suryavamshi (BS-MS 5th year student who finished his degree successfully). So far, no news about his future employment.

Dr. Dond Asha Kisan
Assistant Professor Grade I

A posteriori error analysis for a distributed optimal control problem governed by the von Kármán equations: In this project, we have discussed numerical analysis of the distributed optimal control problem governed by the von Kármán equations defined on a polygonal domain in two dimensions. The state and adjoint variables are discretised using the nonconforming Morley finite element method and the control is discretized using piecewise constant functions. A priori and a posteriori error estimates are derived for the state, adjoint and control variables. The a posteriori error estimates are shown to be efficient. Numerical results that confirm the theoretical estimates are presented.



This is joint work with Dr. Sudipto Chowdhury (LNMIIT), Prof. Neela Nataraj (IITB) and Dr. Devika Shylaja (IITM).
MWENO scheme for hyperbolic conservation laws with non-convex flux: Many multi-resolution WENO schemes fail to resolve the composite structure and converge to a non-entropy solution for hyperbolic conservation laws with non-convex flux. We introduce a modified version of WENO schemes, which resolve the composite structure and ensure entropic convergence. The algorithm employs the first order modification in the troubled-cell and fifth-order WENO scheme in the non-troubled cell. To identify troubled cells, we have developed a new troubled-cell indicator utilizing the smoothness indicator of the multi-resolution WENO scheme.



This is joint work with Dr. Rakesh Kumar (IISER-TVM).

Dr. Saikat Chatterjee
Assistant Professor Grade I

(1) Chern-Weil theory for Lie groupoids and differentiable stacks. Indranil Biswas, Saikat Chatterjee, Praphulla Koushik, Frank Neumann

Let $X = [X_Z \Rightarrow X_0]$ be a Lie groupoid equipped with a connection, given by a smooth distribution TX_1 transversal to the fibers of the source map. Under the assumption that the distribution is integrable, we define an analog of de Rham cohomology for the pair (X,) and study connections on principal G- bundles over (X,) in terms of the associated Atiyah sequence of vector bundles. Finally, we develop the corresponding Chern-Weil theory and study characteristic classes of principal G-bundles over (X,).

(2) Atiyah sequences and connections on principal bundles over Lie groupoids and differentiable stacks. Indranil Biswas, Saikat Chatterjee, Praphulla Koushik, Frank Neumann We construct and study general connections on Lie groupoids and differentiable stacks as well as on principal bundles over them using Atiyah sequences associated to transversal tangential distributions.

(3) Extension of topological groupoids and Serre, Hurewicz morphisms. Saikat Chat- terjee, Praphulla Koushik In this paper, we introduce the notion of a topological groupoid extension and relate it to the already existing notion of a gerbe over a topological stack. We study the properties of a gerbe over a Serre, Hurewicz stack.

(4) Atiyah sequences of a Lie 2-group bundle over a Lie groupoid. Saikat Chatterjee, Adittya Chaudhury, Praphulla Koushik
In this paper, a notion of a principal 2-bundle over a Lie groupoid has been introduced. It has been shown that every such Lie 2-group bundle admits a short exact sequence of VB groupoids over a Lie groupoid, namely the Atiyah sequence of VB groupoids. Two notions of connection structures viz. strict connections and semi-strict connections on them arising respectively, from a retraction of the Atiyah sequence and a retraction up to a natural isomorphism have been intro- duced. Such connections have also been described in terms of the Lie 2-algebra valued differential forms. A connection on a Lie 2-group G = [G1 => G0]-bundle over a Lie groupoid X = [X1 => X0] have been constructed from a connection on a given G0-bundle over [X1 => X0]. An existence criterion for the connections on a Lie 2-group bundle over a proper, ´etale Lie groupoid has been proposed. The action of the gauge 2-group of the gauge transformations on the category of strict and semi-strict connections has been studied. A special type of gauge symmetry of the category of semi-strict connections has been observed.

(5) Pushforwards and Gauge Transformations for Categorical Connections. Saikat Chatterjee, Amitabha Lahiri, Ambar Sengupta

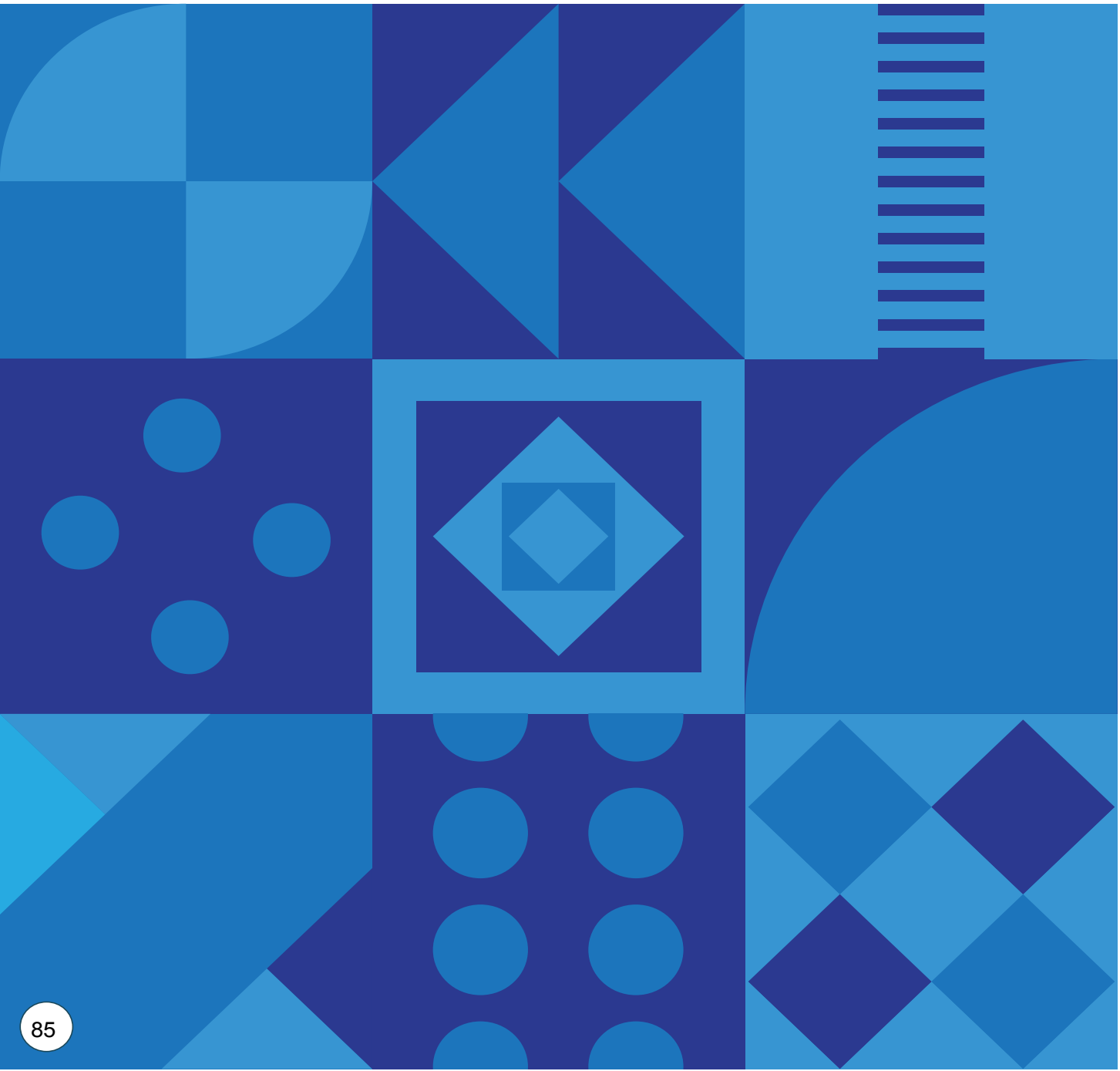
Summary Of Research In Last One Year

We construct and study pushforwards of categorical connections on categori- cal principal bundles. Applying this construction to the case of decorated path spaces in principal bundles, we obtain a transformation of classical connections that combines the traditional gauge transformation with an affine translation.

Publication

(1) On two notions of a gerbe over a stack, Saikat Chatterjee, Praphulla Koushik, Bulletin des Sciences Math´ematiques, 163, October 2020, 102886

Academic Programs



ACADEMIC PROGRAMMES

Ph. D. PROGRAMME

School-wise distribution of Ph. D. student as on March 31,2021.

Name Of School	Nos.
SOB	58
SOC	91
SOM	12
SOP	72
Total	233

During the August 2020 and January 2021 admission sessions, 67 students were admitted to the Ph. D. pogramme

Name Of School	Nos.
SOB	9
SOC	26
SOM	10
SOP	22
Total	67

Sources of Fellowships For Ph. D. Students

Name Of Fellowship	Nos.
CSIR	50
DBT	2
INSTT.	119
INSPIRE	28
PMRF	2
UGC	32
TOTAl	233

Due to covid-19 pandemic, convocation deferred in the year 2020. 16 students were conferred Ph. D. degree

Category-Wise distribution of Ph. D Students

GENDER	EWS	GEN	OBC_NCL	PD	SC	ST	TOTAL
MALE	2	68	45	0	10	0	125
FEMALE	0	73	35	0	0	0	108
TOTAL	2	141	80	0	10	0	233

The following students have successfully completed the requirements for the award of Ph. D. degree (completed thesis defense on or before March 31, 2021

Sl.No.	Name	Registration No.	School	Title Of Thesis	Research Supervisor
1	Sreeja V Nair	Phd132012	SOB	Functional Characterization Of Rnf167 And Its Variants In Lysosomal Positioning,Ubiquitin Ligase Functions, And Nf-Kb Signaling	Prof S. Murty Srinivasula
2	Sreesha R Sudhakar	Phd131016	SOB	The Role Of Insulin Producing Cells (Ipcs) In Hunger Induced Feeding And Nutrient Sensing In Drosophila Melanogaster	Dr. Jishy Varghese
3	Asha. P	Phd152002	SOC	Metal-Organic Frameworks As A Remedy For Water Pollution – Sensing And Removal.	Dr. Sukhendu Mandal, Prof. Federica Bianchi
4	Manju P	Phd132009	SOP	Bazro3 Ceramic Production, Single Crystal Growth And Vortex Phase Diagram Of $Yba_2cu_{3-x}al_xo_{6+\delta}$ High-T_c Superconductor.	Dr. Deepshikha Jaiswal Nagar

5	Lakshmi. K. P	Phd141008	SOP	Investigation Of Antimony Based Electrodes For Rechargeable Batteries.	Dr. M M Shaijumon
6	Soumitra Hazra	Phd131015	SOP	Terahertz And Pump-Probe Spectroscopy Of Spin Ladder Compounds.	Dr. Rajeev N. Kini
7	Dhanya Radhakrishnan	Phd151005	SOB	Mechanisms Of Regeneration In Plants	Dr. Kalika Prasad
8	Binshad B	Phd142006	SOB	Regulation Of Centriole Biogenesis By E3 Ubiquitin Ligase Fbxw7	Prof. Tapas Kumar Manna
9	Siriki Atchimnaidu	Phd142011	SOC	Design And Synthesis Of Functional Dna Nanostructure: Applications In Cancer Therapy And For The Capture Of Micropollutants From Water.	Dr. Reji Varghese
10	Hemna Fathima.	Phd142008	SOC	Plasmonic Substrates For Surface-Enhanced Raman Scattering Based Sensing	Prof. K George Thomas
11	Neethu Anand	Phd151023	SOC	Nonadiabatic Excited – State Intramolecular Proton Transfer In Hydroxypyrone Analogs.	Dr. Vannapusa Sivaranjana Reddy
12	Raju	Phd151027	SOC	Cationic Zinc Hydrides For Carbon Dioxide Reduction.	Dr. Ajay Venugopal

13	Anjana P K	Phd131003	SOC	Exploration Of A Few Vanadium Based Hybrid Compounds As Active Anode Materials In Lithium – Ion Batteries.	Anjana P K
14	Ashby Philip John	Phd131004	SOP	Electrical Contacts On Mos2 : Influence Of Starin And Gating.	Dr. Madhu Thalaku-
15	Prahalad Kanti Barman	Phd141012	SOP	Valleytronics In 2d Transition Metal Dichalcogenides.	Dr. Rajeev N Kini
16	Krishna Nand Prajapati	Phd141007	SOP	Zno Emission: From Photoluminescence To Surface Enhance Raman Spectroscopy.	Dr. Rajeev N Kini

INTEGRATED Ph. D.. PROGRAMME

Integrated Ph. D. student numbers across schools

Name Of School	Nos.
SOB	24
SOC	60
SOM	30
SOP	38
TOTAL	152

No. of. Int. Ph. D. Students Admitted During August 2020 = 40 Nos.

Name Of School	Nos.
SOB	6
SOC	15
SOM	9
SOP	10
TOTAL	40

Integrated Ph. D. students Sandip Guchhait and Probal Nag were selected to receive the Prime Minister's Research Fellowship (PMRF) during the year.

Due to Covid-19 pandemic, convocation deferred in the year 2020. In the year 2020, four integrated phd students awarded dual master's and Ph. D. degrees.

Roll No/Name:

1. IPHD13008: Gopal M (SoB)

2. IPHD13001:Akash Ashirbad Panda (SoM)

3. IPHD13002:Ammu Elizabeth Antony(SoM)

4. IPHD13013:Soham Bhattacharyya(SoP)

Name Of Fellowship	Nos.
CSIR	1
PMRF	4
INSTT.	147
TOTAL	152

Category-wise numbers of Integrated Ph. D. Students

GENDER	EWS	GEN	OBC_NCL	PD	SC	ST	TOTAL
MALE	0	76	14	0	1	0	91
FEMALE	0	45	16	0	0	0	61
TOTAL	0	121	30	0	1	0	152

BS-MS PROGRAMME

Category-wise distribution of students enrolled in 2020

GENDER	EWS	GEN	OBC_NCL	PD	SC	ST	TOTAL
MALE	9	45	42	2	12	12	122
FEMALE	12	73	63	2	17	9	176
TOTAL	21	118	105	4	29	21	298

Subsequent to admission, 26 students discontinued from the programme and final number enrolled in 2020 was 272.

Total BS-MS Student Strength during 2020-21

GENDER	EWS	GEN	OBC_NCL	PD	SC	ST	TOTAL
MALE	13	259	136	7	61	33	509
FEMALE	17	229	172	6	71	24	519
TOTAL	30	488	308	13	132	57	1028

From the 2020 batch, 57 were found eligible for receiving DST-INSPIRE scholarship and 3 students qualified for KVPY scholarship.

Sources of Fellowship for BS-MS students

Name Of Fellowship	Nos.
DST-INSPIRE	339
KVPY	67
TOTAL	406

LIST OF BS-MS STUDENTS WITH PROJECT DETAILS

SI	Roll Number	Name	Title	Supervisor	School
1	IMS14091	Manas B Sharma	Choice of Clock Model is not the Primary Factor affecting Accuracy in Estimation of Lineage Divergence Time Through Bayesian Inference	Dr. Ullasa Kodandaramaiah	Biology
2	IMS15001	A.K. Avinash	Role of CARP2 in Regulation of Oxidative Stress induced Cell Death	Dr. S. Murty Srinivasula	Biology
3	IMS15004	Abdul Basith T	Understanding the Role of Lint Gene in Drosophila Insulin Signaling and Development	Dr. Jishy Varghese	Biology
4	IMS15022	Amanda Ben	Influence of Behavioural Context and Multimodal Integration in the Colour Preference of Catopsilia Pomona	Dr. Ullasa Kodandaramaiah	Biology
5	IMS15027	Anish Ruban S	Investigating the Role of DNA Polymerase Pol Y1 In Promoter Base Substitutions and Indels	Dr. Sabari Sankar Tirupathy	Biology
6	IMS15030	Anjaly P J	Elucidating the role of Spindle and Kinetochore Associated Proteins in Microtubule-Kinetochore Interaction	Dr. Tapas K Manna	Biology
7	IMS15031	Ann Mary Isaac	Understanding the Entry Mechanisms of Middle East Respiratory Syndrome Coronavirus (MERS-CoV)	Dr. V. Stalin Raj	Biology
8	IMS15036	Arathi Preeth Babu	Regulation of Insulin Producing Cells Function by Slimfast	Dr. Jishy Varghese	Biology
9	IMS15039	Arya Krishnan	Structure-Function Studies of Spindle-Kinetochore Associated Proteins	Dr. Tapas K Manna	Biology

10	IMS15040	Ashwathi Prithviraj	A Study on the Possible Role of CCHamide 1 in the interplay between the Circadian Clock and Metabolism	Dr.Nisha N Kannan	Biology
11	IMS15041	Asif Mohammed A N	Understanding the Molecular Basis of Circadian Clock Precision in Drosophila Melanogaster Populations Selected for Narrow Gate of Adult Emergence	Dr. Nisha N Kannan	Biology
12	IMS15052	Dheeraj K P	CARP2 is a Novel Regulator of Lysosomal Distribution and Acidification	Dr. S. Murty Srinivasula	Biology
13	IMS15056	Divya R	Insights of Naturally Occurring Superman Gene Standardising Crispr Mediated Mutation	Dr. Ravi Maruthachalam	Biology
14	IMS15066	Harikrishan J	Production of Replication Incompetent Dengue and Japanese Encephalitis Pseudovirus	Dr. V Stalin Raj	Biology
15	IMS15069	J. Haritha	Analysis of Meiotic Mutants in Natural Hybrids of Saccharomyces Cerevisiae	Dr. Nishant K T	Biology
16	IMS15072	Jewel Johnson	Visual Ecology of the Giant Honeybee, Apis Dorsata	Dr. Hema Somanathan	Biology
17	IMS15079	Krishnapriya Anirudhan	Role of Arabidopsis NNF1 in Polyamine Regulation	Dr. Ravi Maruthachalam	Biology
18	IMS15092	Mohammed Afsal B	Molecular Characterisation of Mini-Chromosome Induced Bushy Mutation in Arabidopsis Thaliana and SUPERWOMAN; A Natural Epiallelic Mutaion In SUPERMAN Gene	Dr.Ravi Maruthachalam	Biology
19	IMS15100	Nayana J M	Targeting the Uptake of 3-IODO-L-Tyrosine EMGFP in Mammalian Cells.	Dr. N Sadananda Singh	Biology

20	IMS15104	Pawar Omkar Eknath	Spontaneous Colour Preferences in Two Satyrine Butterfly Species	Dr. Ullasa Kodandaramaiah	Biology
21	IMS15115	Rakhshana B Krishnan	Optimization of Crystallization Conditions Of Rv1377c from Mycobacterium Tuberculosis and other modes of obtaining Protein Crystals	Dr. Ramanathan Natesh	Biology
22	IMS15126	Shastri Awanti Milind	Understanding Mass Flights in Asian and European Honeybees (Apis Cerana and Apis Mellifera)	Dr. Hema Somanathan	Biology
23	IMS15128	Siddhartha Yaddanapudi	Deciphering the Role of miR-184 in Growth and Development of Drosophila Melanogaster	Dr. Jishy Varghese	Biology
24	IMS15129	Sneha Santhosh	Validation of Antimicrobial Proteins Associated With ALIS (Aggresome Like Induced Structures)	Dr. S Murty Srinivasula	Biology
25	IMS15133	Sowmiya B	X-Ray Diffraction and Data Collection Of Mycobacterium Tuberculosis LexA mut	Dr. Ramanathan Natesh	Biology
26	IMS15134	Sowmya S Geetha	Genome-wide association of Slx1/Slx4 during Meiosis in Saccharomyces Cerevisiae	Dr. Nishant K T	Biology
27	IMS15138	Sreerag S Reghu	Nuclear Translocation of CARPs	Dr. S Murty Srinivasula	Biology
28	IMS15139	Sreerag Sreedhar	Understanding the Role of Integrin Signalling in Bone Marrow Niche Modulation	Dr. Satish Khurana	Biology
29	IMS15140	Srepriya M.S.	Role of DNA Polymerase Pol Y2 in Collision-Induced Spontaneous Mutations	Dr. Sabari Sankar Thirupathy	Biology

30	IMS15143	Suvarna. K	Interactions of Optic Flow and Landmark Guidance During Food Search in Stingless Bees and Spatial Resolution and Contrast Sensitivity During Navigation of Tetragonula Iridipennis	Dr. Hema Somanathan	Biology
31	IMS15147	Tharunya Thankachan	Effect of Niche Metabolism on the Hematopoietic Stem Cell Function	Dr. Satish Khurana	Biology
32	IMS15155	Zayana Ali	An Alternative Hybrid for Meiotic Recombination Studies in Saccharomyces Cerevisiae	Dr. Nishant K T	Biology
33	IMS14114	Rajat Kumar Singh	"Synthesis of Sulfonylated Indoles and Other Heterocycles & Recent Advances in Asymmetric 1,6-Conjugate Addition Reactions of para-Quinone Methides (p-QMs)"	Dr Alagiri Kaliyamoorthy.	Chemistry
34	IMS15009	Adil Muhammed	"An Analytical Exploration of Graphene Derivatives for Gas Adsorption"	Dr. R. S. Swathi	Chemistry
35	IMS15012	Aiswarya M.P.	A Computational Study on Anion-Π Interactions involving Graphynes	Dr. R. S. Swathi	Chemistry
36	IMS15016	Ajun E Muthu	Acyl Electrophiles in Deaminative Crosscoupling Reactions and Substituted Phenanthroline Synthesis	Dr.Ramesh Rasappan	Chemistry
37	IMS15018	Akhil Dev D	Synthesis of Oligomers/Polymers Via Catalyzed/Uncatalyzed Azide-Alkyne Cycloaddition	Dr. Kana M Sureshan	Chemistry
38	IMS15023	Amina Mohamed	Periodic Trends in Trispyrazolylborate Compounds: A Computational Investigation	Dr. Ajay Venugopal	Chemistry
39	IMS15026	Ananya S	A Functional Model For Carbon Disulfide Hydrolase Enzyme	Dr. Subrata Kundu	Chemistry

40	IMS15034	Anvy Kuriakose	Plasmonic Resonances in Ag-Au Nanoparticle Heterodimers: How Accurate are the Analytical Descriptions?	Dr. R. S. Swathi	Chemistry
41	IMS15042	Asna V	Aggregation Pathway of K19TH6 through Phase Separation	Dr. Vinesh Vijayan	Chemistry
42	IMS15043	Aswathi Syam	A Chiral Pool Approach for Total Synthesis of (+)-Diaportinol and (-)-Peniisocoumarin H	Dr Rajendar Goreti	Chemistry
43	IMS15058	Elgin Carlose	Oxidative Cross-Coupling of Amines and Alcohols Catalyzed by Tempo Under Transition-Metal-Free Condition & Nickel-Catalyzed Silylation of Secondary Alkyl Methyl Ether via CO Bond Activation & Nickel Catalyzed Synthesis of Acylsilanes from Carboxylic Acid Derivatives using Silylzinc Reagent	Dr. Ramesh Rasappan	Chemistry
44	IMS15059	Faina Pinhero	Structural and Aggregation Studies on the Prion Domains of CPEB3	Dr. Vinesh Vijayan	Chemistry
45	IMS15063	Govind Behera	Synthesis, Structure and Electronic Properties of P-Phenylene Incorporated Macrocycles	Dr. Gokulnath Sabapathi	Chemistry
46	IMS15068	Hridya N	Oxygen Reduction Reaction Activities of La-Based Perovskite Oxides Incorporated With N-Doped Carbon Material	Dr. A Muthukrishnan	Chemistry
47	IMS15070	Jemshiya K	Design and Synthesis of Amphiphilic Dual Drug Conjugate for Combination Cancer Therapy	Dr. Reji Varghese	Chemistry
48	IMS15071	Jesni N J	An Attempt to Synthesize 2D Polymer and Regioselectiveazide-Alkyne Cycloaddition In Cocrystals	Dr. Kana M. Sureshan	Chemistry
49	IMS15073	Jithu Krishna	Disassembly Driven Approach for the Specific Detection of Telomerase in the Cancer Cells Using 19F NMR "OFF/ON" Response	Dr. Reji Varghese	Chemistry

50	IMS15083	Lakshmy Priya A	Bimetallic Nanostructures: Dependence of Core (Au) Size and Shell (Ag) Thickness on SERS	Dr. K. George Thomas	Chemistry
51	IMS15085	M S Ahammed Hussain Madhani	An Attempt to Synthesize 2D Polymer via Topochemical Reaction	Dr. Kana M. Sureshan	Chemistry
52	IMS15087	Meera Madhu	Emergent Excited State Properties of Cofacial Chromophores	Dr. Mahesh Hariharan	Chemistry
53	IMS15088	Meghna Sasi	Fused Porphyrinoids and Related Macrocycles: A Structure Property Correlation	Dr. Gokulnath Sabapathi	Chemistry
54	IMS15094	Muhammed Bilal A	Using Saturation Transfer NMR Techniques to elucidate Transient Dark States Involved in Biological Processes	Dr. Vinesh Vijayan	Chemistry
55	IMS15099	Nandita Mohandas	Chirality in Binaphthol Derivatives and Hexapod Oligo(Phenyleneethynylenes)	Dr. K. George Thomas	Chemistry
56	IMS15102	Nilima M	Design and Synthesis of DNA-Oligohexaphenylbenzene Conjugates	Dr. Reji Varghese	Chemistry
57	IMS15108	Priyanka P. Rajan	Ultrafast Intersystem Crossing in Core-Substituted Naphthalene Diimides	Dr. Vennapusa Sivaranjana Reddy	Chemistry
58	IMS15116	Rohith V S	Synthesis of Pyridinium Salts and Acid Chlorides for Deaminative Cross-Coupling and Synthesis of Starting Materials for Photoredox Enabled Cross Coupling of Aldehydes and Pyridinium Salts	Dr. Rameshrasappan	Chemistry
59	IMS15117	Roopesh M	A New Series of Silver Nanoclusters Based on Thiolates & Phosphines Ligands	Dr.Sukhendu Mandal	Chemistry

60	IMS15121	Sanath Raj Kk	Reactivity Of Nitrite Anion at Copper(Ii) And Nickel(Ii) Sites	Dr. Subrata Kundu	Chemistry
61	IMS15124	Shahana Nizar N S	Photophysical Properties of Molecular Aggregates: Theoretical and Computational Studies	Dr. K. George Thomas	Chemistry
62	IMS15131	Soniya Ahammad	Nitrite Mediated Oxidative Transformations of Aniline at Copper(Ii)	Dr. Subrata Kundu	Chemistry
63	IMS15136	Sreelakshmi M	Studies Toward the Total Synthesis of Serofendic Acid	Dr. Rajendar Goretti	Chemistry
64	IMS15142	Suryakanta Tanty	Semi-Conductive Behaviour Of DPTTZ Based Metal-Organic Framework	Dr. Sukhendu Mandal	Chemistry
65	IMS15151	Vishnu V.	Aggregates of Organic Chromophores: Role of Weak-Interactions and Implications in Photophysics/Opto-Electronics	Dr. Mahesh Hariharan	Chemistry
66	IMS15156	Sravya Surendran	Enhanced Selectivity in Julia-Kocienski Reaction Using Quaternary Ammonium Salt	Dr. Rajendar Goretti	Chemistry
67	IMS15158	Vavilala Veera Bala Manikanta	Synthesis of Ag-Pd Alloy Complex & Study of its Catalytic Activity	Dr. Sukhendu Mandal	Chemistry
68	IMS13045	C H Saraswathy	On Signs of Fourier Coefficients of Certain Modular Forms	Dr. Srilakshmi Krishnamoorthy	Mathematics
69	IMS14084	M. Akhilesh	Algebraic Connectivity and Geometry of Trees	Dr. Sumit Mohanty	Mathematics

70	IMS14116	Richa Singh	Hilbert-Waring Theorem	Dr. Srilakshmi Krishnamoorthy	Mathematics
71	IMS15013	Aji Kurian	Moore Penrose Inverse of Incidence Matrix on Some Classes of Graphs	Dr. Sumit Mohanty	Mathematics
72	IMS15017	Akash Kumar	A Study of Riemannian Geometry	Dr. Saikat Chatterjee	Mathematics
73	IMS15024	Amrutha B Nair	Sysygies of Modules	Dr. Sarbeswar Pal	Mathematics
74	IMS15029	Anjali T C	A Study on Mask R-CNN Algorithm for Object Detection	Dr. M P Rajan	Mathematics
75	IMS15060	G Aswin	Statistical Properties of Simultaneous Dynamics	Dr. Shrihari Sridharan	Mathematics
76	IMS15064	Govind S	Privacy Preserving Logistic Regression and Deep Learning	Dr. Devaraj P	Mathematics
77	IMS15077	Kirthana R	Counting of Closed Orbits	Dr. Shrihari Sridharan	Mathematics
78	IMS15090	Mithun P V	Class Field Theory: A Cohomological Approach	Dr. Viji Z. Thomas	Mathematics
79	IMS15095	Muhammed Dilshah U	Application of Finite Element Method in Computational Nano-Optics	Dr. Dharmatti Sheetal	Mathematics

80	IMS15098	Nafia V K	On the Prime Factors of X 2 − 1 & Odd Perfect Numbers	Dr. Srilakshmi Krishnamoorthy	Mathematics
81	IMS15103	Nimisha B	Cryptanalysis of Dual RSA and a Digital Signature Scheme	Dr. Srilakshmi Krishnamoorthy	Mathematics
82	IMS15105	Chandana Deeksha	Application of the Finite Element Method to Image Processing	Dr. Dharmatti Sheetal	Mathematics
83	IMS15122	Sanjeev Nanda P	A Study on Deep Learning Based Algorithm for Object Detection	Dr. M. P. Rajan	Mathematics
84	IMS15135	Sreehari K	Elliptic Curve Cryptography And Lattice Based Cryptography	Dr. Srilakshmi Krishnamoorthy	Mathematics
85	IMS15144	Swetha Ganesh	Laplacian Matrix of Graphs With Matrix Weights on Edges	Dr. Sumit Mohanty	Mathematics
86	IMS15146	Tarini S	Dualities in Strict Polynomial Functors	Dr. T. Geetha	Mathematics
87	IMS15148	Vidya V.Babu	Kinetic Scheme for the Euler Equations	Dr. K. R. Arun	Mathematics
88	IMS15157	Dharmadhikari Ganesh Jayantrao	Some Problems in Number Fields	Dr. Srilakshmi Krishnamoorthy	Mathematics
89	IMS14011	Amit Kumar	Resistive Switching and ZnO as Memristor	Dr. Joy Mitra	Physics

90	IMS14027	Arun Kumar	Reduced Graphene Oxide (RGO) Deposition by Spray Pyrolysis	Dr. Vinayak B. Kamble	Physics
91	IMS14072	Kartike	Study Of ZnO as a Semiconductor	Dr. Joy Mitra	Physics
92	IMS15002	A P Sreehari	Scattering Amplitudes in Gauge Theory and Gravity	Dr. Bindusar Sahoo	Physics
93	IMS15003	Abdu Subahan M	Investigation of Intensity Modulation Based Frequency Combs in the 2μm Wavelength Regime	Dr.Ravi Pant	Physics
94	IMS15008	Adarsh Sudhakar	Finite Element Method Based Scheme for Reconstruction of the Optical Absorption Distribution from Photoacoustic Signals	Dr. Suhesh Kumar Singh	Physics
95	IMS15010	Adithiya Dinesh	Weak Lensing of Cosmic Micro-wave Background	Dr. Soumen Basak	Physics
96	IMS15011	Adithya Jayakumar	Hydrogen Sensor Based on Palladium Nanoclusters	Dr. Deepshika Jaiswal Nagar	Physics
97	IMS15015	Ajmal S	Coherent Perfect Absorber	Dr. K Shadak Alee	Physics
98	IMS15019	Akshay S	Area Dependence of Device Parameters in Bulk Heterojunction Organic Solar Cells	Dr. Manoj A G Namboothiry	Physics
99	IMS15020	Aleesha P.A	Application of Multi-Fano and EIT-Like Resonances in Microwave Photonic Signal Processing	Dr. Ravi Pant	Physics

100	IMS15025	Anagha A G	PT-Symmetric Coupled Waveguides With Gain-Loss Asymmetry	Dr. K. Shadak Alee	Physics
101	IMS15032	Anoop K	Phase Engineering 2D Materials by Ionic Liquid Gating	Dr. Madhu Thalakulam	Physics
102	IMS15033	Aparna M. Das	Transition Metal Based Nanoparticles Dispersed on Carbon Matrix as Efficient ORR Catalysts	Dr. M. M. Shaijumon	Physics
103	IMS15035	Aparna Vasudevan K	Electrostatic Control of Schottky Barrier in 2D Materials	Dr. Madhu Thalakulam	Physics
104	IMS15037	Archa A Nair	Growth and Optimization of Nanorods for Enhanced Boiling Heat Transfer and Optoelectronics	Dr. Vinayak B. Kamble	Physics
105	IMS15048	Chandni Babu	Study of Valley Carrier Dynamics of TMDCs Using Time-Resolved Second Harmonic and THz Generation	Dr. Rajeev N. Kini	Physics
106	IMS15049	Ciril S Prasad	Carbon-Based Materials for Electrocatalytic Co2 Reduction: Effect of Heteroatom Doping	Dr. M. M. Shaijumon	Physics
107	IMS15054	Dhruv	Mixed Oxide Coatings by RF Magnetron Sputtering for Spectrally Selective Solar Absorbers	Dr. Vinayak B. Kamble	Physics
108	IMS15055	Disha Brahma	Restricted Boltzmann Machine Learning of Kitaev Heisenberg Ladder Model	Dr. Amal Medhi	Physics
109	IMS15057	Dumpala Tirumalarao	Synthesis of Phase Pure Nano-Sized Powders Of BaZrO3 by Optimising the pH Conditions in a Sol-Gel Autocombustion Technique	Dr. Deepshikha Jaiswal Nagar	Physics

110	IMS15061	Gaayatri Chandrasekharan	Application of Minkowski Functionals in Two-Phase Systems	Dr. Sreedhar B. Dutta	Physics
111	IMS15074	Joyal John Abraham	Investigation of the Ground State Properties in a Kitaev Honeycomb Lattice BiYbGeO5	Dr. R. C. Nath	Physics
112	IMS15075	Jyothis Chandran	Harmonic Domain Internal Linear Combination (ILC) for Analysis of CMB Data and the effect of Its Bias	Dr. Soumen Basak	Physics
113	IMS15078	Krishna Kumar	Effect of Adaptive Couling Using Low Pass Filters in Mean-Field Diffusive Coupled Dynamical Oscillators	Dr. D.V. Senthilkumar	Physics
114	IMS15093	Muhammad Arshad T P	Whispering Gallery Mode Based Light Amplification in Micro-Droplets	Dr. K. Shadak Alee	Physics
115	IMS15096	Muhsin Vannan Chali	Investigation of Ni Based Materials for Energy Storage and Conversion Applications	Dr. M. M. Shaijumon	Physics
116	IMS15097	Muthusamy R	A New Density Formula in N = 2 Conformal Supergravity	Dr. Bindusar Sahoo	Physics
117	IMS15101	Neha K	Thermal Expansion Measurements of Solids using Capacitive Dilatometry	Dr. Deepshikha Jaiswal Nagar	Physics
118	IMS15107	Praseeda M S	Non-Markovianity and Divisibility in Open Quantum Dynamics	Dr. Anil Shaji	Physics
119	IMS15110	R. Naveen Kumar	Random Lasers	Dr. K. Shadhak Alee	Physics

120	IMS15112	Raghav Chaturvedi	A Study of Metal-Insulator Transitions in Twisted Bilayer Graphene using Z2 Slave Spin Theory	Dr. Subrata Kundu	Physics
121	IMS15118	S.Kalyani	Thermoelectric Study of LaCoO3/-La1-xSrxCoO3 Superlattice Thin Films by RF Magnetron Sputtering	Dr. K. George Thomas	Physics
122	IMS15119	Saddal Kuljeet Singh	Relativistic Hydrodynamics	Dr. Subrata Kundu	Physics
123	IMS15125	Shahla Yasmin M	Non-Linear Terahertz Spectroscopic Studies in Sr14Cu24O41	Dr. Rajendar Goretti	Physics
124	IMS15127	Sheena Shaji	Electronic Study of 2-D Electron Gas in Si/SiGe Heterostructures	Dr. Sukhendu Mandal	Physics
125	IMS15132	Sharath Sasikumar	Use of Axially Symmetric Polarized Light for Spectral Analysis of Plasmonic Focusing	Dr. Mahesh Hariharan	Physics
126	IMS15137	Sreelekshmi Pillai	Periodically Driven Kinetic Ising Models	Dr. Rajendar Goretti	Physics
127	IMS15141	Sulochana R	Ab-Initio Determination of Thermoelectric Properties of ZrIrSb	Dr. Sukhendu Mandal	Physics
128	IMS15145	Syam Prasad S	Finite Element Method(FEM) Based Study on Diffuse Optical Tomography	Dr. Srilakshmi Krishnamoorthy	Physics
129	IMS15149	Vinu K. Vijayakumar	Detection of Chemicals Using Surface-Enhanced Raman Spectroscopy	Dr. Sumit Mohanty	Physics
130	IMS15152	Vishnulal C	Emission of Gravitational Waves and Post-Newtonian Approximation	Dr Soumen Basak	Physics

LIST OF PUBLICATIONS FOR THE PERIOD 2020-21

SCHOOL OF MATHEMATICS

1. Arumugasamy, C., S. Jayaraman, and V. N. Mer. 2020. "A Characterization of Nonnegativity Relative to Proper Cones." Indian Journal of Pure & Applied Mathematics 51, no. 3 (Sep): 935-944. https://dx.doi.org/10.1007/s13226-020-0442-4.

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4. Biswas, T., S. Dharmatti, and M. T. Mohan. 2020. "Maximum Principle for Some Optimal Control Problems Governed by 2d Nonlocal Cahn-Hillard-Navier-Stokes Equations." Journal of Mathematical Fluid Mechanics 22, no. 3 (Jun). https://dx.doi.org/10.1007/s00021-020-00493-8.

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7. Chatterjee, S., A. Sen, S. Roy, G. K. Nivedita, A. Paul, S. Das, and S. Biswas. 2020. "Study of Charging up Effect in a Triple Gem Detector." Journal of Instrumentation 15, no. 9 (Sep). https://dx.doi.org/10.1088/1748-0221/15/09/t09011.

8. Das, J., and S. Mohanty 2020. "Distance Matrix of a Multi-Block Graph: Determinant and Inverse." Linear & Multilinear Algebra. (Dec) https://dx.doi.org/10.1080/03081087.2020.1860886.

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12. Manna, S., and T. C. Anjali. 2020. "Rayleigh Type Wave Dispersion in an Incompressible Functionally Graded Orthotropic Half-Space Loaded by a Thin Fluid-Saturated Aeolotropic Porous Layer." Applied Mathematical Modelling 83 (Jul): 590-613. https://dx.doi.org/10.1016/j.apm.2020.02.007.

13. Manna, U., and D. Mukherjee. 2021. "Weak Solutions and Invariant Measures of Stochastic Oldroyd-B Type Model Driven by Jump Noise." Journal of Differential Equations 272 (Jan): 760-818. https://dx.doi.org/10.1016/j.jde.2020.10.009.

14. Manna, U., and A. Panda. 2020. "Local Existence and Blow-up Criterion for the Two and Three Dimensional Ideal Magnetic Benard Problem." Electronic Journal of Differential Equations (Sep).

15. Pereira, R. G. 2020. "Critical Dynamics of the Nonconserved Strongly Anisotropic Permutation Symmetric Three-Vector Model." Physical Review E 102, no. 6 (Dec). https://dx.doi.org/10.1103/PhysRevE.102.062150.

SCHOOL OF BIOLOGY

1. Albert, S. K., M. Golla, N. Krishnan, D. Perumal, and R. Varghese. 2020. "Dna-Pi Amphiphiles: A Unique Building Block for the Crafting of Dna-Decorated Unilamellar Nanostructures." Accounts of Chemical Research 53, no. 11 (Nov): 2668-2679. https://dx.doi.org/10.1021/acs.accounts.0c00492.

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8. Chellappan, S., S. Mathivanan, R. Thippeswamy, M. Nagesh, H. S. Savithri, and M. R. N. Murthy. 2020. "Crystal Structure of Oxalate Decarboxylase from Photorhabdus Luminescens, a Symbiotic Bacterium Associated with Entomopathogenic Nematodes." Current Science 119, no. 8 (Oct): 1349-1356. https://dx.doi.org/10.18520/cs/v119/i8/1349-1356.

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12. Gopalakrishnan, S., and N. N. Kannan. 2021. "Only Time Will Tell: The Interplay between Circadian Clock and Metabolism." Chronobiology International 38, no. 2 (Feb): 149-167. https://dx.-doi.org/10.1080/07420528.2020.1842436.

13. Gupta, H., R. Rajeev, R. Sasmal, R. M. Radhakrishnan, U. Anand, H. Chandran, N. R. Aparna, S. Agasti, and T. K. Manna. 2020. "Sas-6 Association with Gamma-Tubulin Ring Complex Is Required for Centriole Duplication in Human Cells." Current Biology 30, no. 12 (Jun): 2395-+. https://dx.-doi.org/10.1016/j.cub.2020.04.036.

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17. Jacob, J., A. P. Rayaroth, A. J. K. Useph, R. Philip, and R. Damodaran. 2020. "A Novel Species Spinonema Gracilispiculum Sp. N. (Nematoda: Desmodoridae) from the Oxygen Minimum Zone of Eastern Arabian Sea Margin." Zootaxa 4869, no. 4 (Nov): 587-598. https://dx.doi.org/10.11646/zootaxa.4869.4.6.

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CHEMISTRY/ PHYSICS

1. Anjana, P. K., B. Babu, M. M. Shaijumon, and A. Thirumurugan. 2020. "Lithium-Ion-Based Electro-chemical Energy Storage in a Layered Vanadium Formate Coordination Polymer." Chempluschem 85, no. 6 (Jun): 1137-1144. https://dx.doi.org/10.1002/cplu.202000283.

2. Maman, M. P., A. Nath, S. Anjusree, B. C. Das, and S. Mandal. 2021. "Reversible Polymorphic Structural Transition of Crown-Like Nickel Nanoclusters and Its Effect on Conductivity." Chemical Communications 57, no. 23 (Mar): 2935-2938. https://dx.doi.org/10.1039/d1cc00402f.

PHYSICS/BIOLOGY

1. Phani, D., R. K. Varadarajulu, A. Thomas, R. Paramu, M. S. Singh, V. S. Shaiju, V. Muraleedharan, and R. K. Nair. 2020. "Acoustic and Ultrasonographic Characterization of Polychloroprene, Beeswax, and Carbomer-Gel to Mimic Soft-Tissue for Diagnostic Ultrasound." Physical and Engineering Sciences in Medicine 43, no. 4 (Dec): 1171-1181. https://dx.doi.org/10.1007/s13246-020-00919-7.

HUMANITIES

1. Madhavan, H., and J. P. Gaudilliere. 2020. "Reformulation and Appropriation of Traditional Knowledge in Industrial Ayurveda: The Trajectory of Jeevani." East Asian Science Technology and Society-an International Journal 14, no. 4 (Dec): 603-621. https://dx.doi.org/10.1215/18752160-8771025.

DEPARTMENTAL ACTIVITIES

SCHOOL OF CHEMISTRY

April 2020 - March 2021

SEMINARS AND TALKS	
TALKS BY NATIONAL EXPERTS	
1	***January 07, 2021*** **A Chemist's Approach towards Solving Industrial Problems** Dr. Padma S Vankar, Ex-Principal Research Scientist, Facility for Ecological and Analytical Testing, Indian Institute of Technology, Kanpur This talk focussed on the chemist's approach to problem solving. Dr. Padma Vankar stressed on the need for collaborations between premier research institutes in the country and the R&D sections of industry, to promote sustainability and ensure technological upgradation, especially in sectors such as textiles, agriculture, food processing, environmental management. Dr. Padma pointed out the several instances where such collaboration between research institutes and industry had led to development of industrially viable strategies, workable technologies and eco-friendly alternatives for use by society.
2	***December 02, 2020*** **"PhD Students' Chemical Science Slam -2020"** • Opening Remarks: Dr. Sukhendu Mandal Head, School of Chemistry • Introduction to the Inaugural Speaker: Prof. J. N. Moorthy ,Director, IISER Thiruvananthapuram • Inaugural Talk: Dr. A Ajayaghosh Director, CSIR-NIIST Thiruvananthapuram • RSC - Special Address: Mr. Ajit K. Sharma General Manager - India, RSC • RSC - Supporting Chemical Sciences In India: Mr. Ershad Abubacker Assistant Editorial Development Manager - India, RSC ***Student Talks*** • Ms. Deepti Sharma, Topic: "Switching Lewis Acidity Gears Between Antimony and Bismuth" • Ms. Amritha R., Topic: "1,6-Conjugate Addition of Alkylazaarenes to para-Quinone Methides" • Ms. Swathi K, Topic: "Supramolecular Chirality: A Caveat in Assigning the Handedness of Chiral Aggregates" • Mr. Sulfikarali Thondikkal, Topic: "Design, Synthesis and Properties of m-Phenylene Embedded Porphyrinoids" • Mr. Cijil Raju, Topic: "Topochemistry: An Attractive Method for Polymer Synthesis" • Ms. Lijina M. P, Topic: "Exciton Isolation in Cross-Pentacene Architecture" • Ms. Arya Gopal,Topic: "Kinetic Insights into the Mechanism of Oxygen Reduction Reaction on Fe O /C Composites" • Ms. Meera Johny, Topic: "Tethered oxocarbenium ion initiated oxirane opening reaction - conversion of 2,3-epoxy alcohols to fully protected triols"

	• Ms. Feba Thomas, Topic: "Nickel-Catalyzed Cross-Coupling of Alkyl Carboxylic Acid Derivatives with Pyridinium salts via C-N Bond Cleavage" • Mr. D. Perumal, Topic: "Disassembly Driven Approach for the Specific Detection of Thrombin Using F NMR in "OFF/ON" Response" • Ms. Shourya Gupta, Topic: "Mechanistic Insights into the Signalling Routes of NO and H S" • Ms. Sayani Mukherjee,Topic: "Defect Engineering on Ceria using [Au (PPh) I] for Mimicking Single-Atom Catalysis" • Ms. Chris John,Topic: "Swarm Intelligence Steers Global Minima Search of Clusters Bound on Carbon Nanostructures" • Ms. Shamna M, Topic: "Preparation of HKUST-1@Nanocellulose Composite Membranes for Applications in Gas Separation" • Mr. Sai Vamsi Krishna Isukapalli, Topic: "Journey Through the Realm of Ultrafast Dynamics: Unravelling the Early Events upon Photoexcitation" • Ms. Dhanya S. R, Topic: "Structural Basis for the Long-Term Memory in Mammals"
3	***November 11, 2020*** • **Microstructural Control in Supramolecular Polymers** • Prof. Subi Jacob George, JNCASR Bangalore, INDIA) • This lecture described the preliminary efforts of Prof. Subi Jacob George's research group in constructing, axial organic heterostructures (multi-component supramolecular block co-polymers) via kinetically and thermodynamically controlled Supramolecular Polymerization. Having understood that a synergy between structural and temporal control is important for the advent of supramolecular polymers to be employed as functional adaptive materials, the team acquired spatio-temporal control over the supramolecular polymerization. The talk also focussed on the current work of Prof. George's research group, that of addressing the next level of complexity with sequence controlled, multi-component supramolecular polymerization. According to Prof. George, the unique multi-component, nanostructures made from semi-conducting monomers are organic analogues of well-studied inorganic heterostructures, and have the potential of being used in light harvesting, active wave-guiding and as nanoscale linear p-n junctions.

CAMPS AND WORKSHOPS	
1	***October 16, 2020*** **Wiley Author Workshop** This Author Workshop was conducted by Dr. Partha Pal and Dr. Khusbu Khushwaha (Associate editors – Chemistry). Participants at this workshop interacted with Wiley editors and learnt more about publication ethics, manuscript writing and the role of an editor in academic publishing.

DEPARTMENTAL ACTIVITIES

SCHOOL OF PHYSICS

April 2020 - March 2021

SEMINARS AND TALKS	
TALKS BY NATIONAL EXPERTS	
1	***February 16, 2021*** **Optical Anderson localization in low-dimensional, open, mesoscopic systems** Prof. Sushil A Mujumdar, Nano-Optics and Mesoscopic Optics Laboratory, Tata Institute of Fundamental Research (TIFR), Mumbai, India
2	***February 09, 2021*** **Photonics for health care** Prof. P K Gupta, Formerly at Physics Department, IIT Delhi, and Laser Biomedical Applications Division, Raja Ramanna Centre for Advanced Technology, Indore
3	***January 22, 2021*** **Modelling Metals and Insulators** Dr. Joy Mitra, Indian Institute of Science Education and Research Thiruvananthapuram
4	***January 22, 2021*** **Theories with Varying Fundamental Constants** Dr. Tanumoy Mandal, Indian Institute of Science Education and Research Thiruvananthapuram
5	***December 08, 2020*** **The fate of many-body localization in the presence of long-range interactions** Dr. Arti Garg, Saha Institute of Nuclear Physics (SINP), Kolkata, India
6	***October 27, 2020*** **Nanowire for Optoelectronic Device Applications** Dr. Samaresh Das, Centre for Applied Research in Electronics, Affiliation: Indian Institute of Technology Delhi, India
7	***October 13, 2020*** **Atomic coherence and quantum synchronization** Dr. Saikat Ghosh, Indian Institute of Technology Kanpur, India

SEMINARS AND TALKS

Talks By International Experts

December 28, 2020

Topological Defects in Active Matter
Mr. Jyotishraj N., Georgia Tech, Atlanta (USA) and University of Barcelona (Spain).

COLLABORATIVE MEETINGS & CONFERENCES

International Collaboration

October 13, 2020

Vaishwik Bharatiya Vaigyanik (VAIBHAV) Summit meeting on "Magnetic and Electronic Materials"

VAIBHAV is an initiative by the Government of India to bring together national experts and international experts with Indian roots, to collaborate on frontier areas of research, to provide practical and innovative solutions to the problems that afflict developing nations. This endeavour also promotes scientific advancement, and industrial growth in the country. Several faculty members from the School of Physics actively participated in the VAIBHAV Summit held on October 13, 2020 under the vertical 'Materials and Processing Technologies', sub-head 'Magnetic and Electronic Materials'. The speakers at the event included notable and well respected academicians, and distinguished researchers from R&D Organizations. The event was attended by about 100 participants from various scientific institutes in the country.

Speakers:

Prof. Ramamoorthy Ramesh, University of California, Berkeley, USA
Prof. Arunava Gupta, University of Alabama, USA
Prof. Suchitra Sebastian, University of Cambridge, UK
Prof. Deepak Singh, University of Missouri, Columbia, USA
Dr. Devashibhai Adroja, ISIS Facility, UK
Prof. Ramanathan Mahendiran, National University of Singapore
Prof. E. V. Sampathkumaran, TIFR Mumbai, India
Prof. Kalobaran Maiti, TIFR Mumbai, India
Prof. Dhananjai Pandey, IIT BHU, India
Dr. Alok Banerjee, UGC-DAE Consortium for Scientific Research, Indore
Dr. S. M. Yusuf, BARC Mumbai, India
Prof. M. S. Ramachandra Rao, IIT Madras, India

DEPARTMENTAL ACTIVITIES

SCHOOL OF BIOLOGY

April 2020 - March 2021

SEMINARS AND TALKS	
Talks By National Experts	
1	***March 17, 2021*** (Proteus – Faculty Talk Series) **Genomics for All** Talk by Dr Gautam Das, miBiome Therapeutics LLP, Mumbai
2	***January 23, 2021*** (Proteus – Faculty Talk Series) **The Circuits of Sensation: How We Perceive the World** Lecture by Prof Shubha Tole, TIFR, Mumbai
3	***December 04, 2020*** (Proteus – Faculty Talk Series) **Whole-body metabolic modelling: scope for personalised medicine** Talk by Dr. Swagatika Sahoo, IIT Madras
4	***November 28, 2020*** (Proteus – Faculty Talk Series) **On model organism: Arabidopsis Thaliana** Talk by Dr. Ravi Maruthachalam, IISER TVM
5	***November 27, 2020*** **Tigers on islands** Talk by Dr. Uma Ramakrishnan, National Centre for Biological Sciences (NCBS)
6	***October 30, 2020*** **Blood cell development: Lessons learned from Drosophila** Talk by Dr. Lolitika Mandal, IISER Mohali
7	***October 20, 2020*** (Proteus – Faculty Talk Series) **Nobel Prize Talk** Talk by Dr. V Stalin Raj, IISER TVM
8	***October 16, 2020*** **New answers to old Questions regarding DNA Synthesis by DNA Polymerases** Lecture by Prof. Deepak Nair, Regional Centre for Biotechnology, Faridabad

9	***October 08, 2020*** (Proteus – Faculty Talk Series) **Tweaking Longevity Pathways in Stem Cells** Lecture by Prof. Maneesha S. Inamdar, JNCASR, Bengaluru
10	***September 18, 2020*** (Proteus – Faculty Talk Series) **Research Experiences** Lecture by Prof. S Murty Srinivasula, IISER TVM
	SEMINARS AND TALKS
	Talks By International Experts
1	***February 19, 2021*** (Proteus – Faculty Talk Series) **Evolution of centromeres: Conserved function, yet diverse architectures** Talk by Dr Innes Anna Drinnenberg, Institute Curie, Paris, France
2	***February 11, 2021*** (Proteus – Faculty Talk Series) **Human Performance Education and Sports Science** Talk by Dr Andy Galpin, California State University, Fullerton
3	***January 15, 2021*** (Proteus – Faculty Talk Series) **Heterogeneity of astrocytes in glycogen content and GPCR-driven dynamics** Lecture by Prof Hajime Hirase, University of Copenhagen, Denmark
4	***January 08, 2021*** (Proteus – Faculty Talk Series) **Exploiting divergent biology of two fission yeasts to understand membrane function** Lecture by Prof Snehzana Oliferenko, Francis Crick Institute, London, UK
5	***November 14, 2020*** (Proteus – Faculty Talk Series) **The Smooth-Coated Otter: Ecology, Behaviours and Field Methods** Talk by Dr. Katrina Fernandez, Director, Wild Otters Research
6	***September to November 2020*** **Indian pollinator initiative: webinar series** The Indian Pollinator Initiative presented the first of a series of online seminars every Friday evening between September and November 2020. The webinar series included an exciting line up of talks on basic and applied pollination biology, from across the world.
7	***November 13, 2020*** **Functional neuroimaging in small animals with high-field fMRI** Talk by Dr. Basavaraju G. Sanganahalli, Yale University

	October 24, 2020 (Proteus – Faculty Talk Series) **Modelling triplet repeat expansions using genome engineering and pluripotent stem cells** Talk by Dr. Poulodi, National University of Singapore
PROTEUS TALKS **Student Talks**	
	09/03/2021 **Journey from IISER to Scientific Illustration** Rafeeque Mavoor, Science Media Center, IISER Pune
	05/11/2020 **Lab experiences in India and Universität Kassel, Germany** Nadi Dixit, PhD Graduate, Universitat Kassel, Germany
	30/09/2020 **Research and Internship Experiences** Siddhartha, PhD Graduate, Indiana University Bloomington

DEPARTMENTAL ACTIVITIES

SCHOOL OF MATHEMATICS

April 2020 - March 2021

SEMINARS AND TALKS	
Talks By National Experts	
1	***March 24, 2021*** **Unimodular rows** Dr. Mrinal Das, ISI Kolkata Dr. Mrinal Das first introduced some basic and classical results on unimodular rows and went on to present their recent research work and some of the open problems in the study.
2	***March 17, 2021*** **Prime-characteristic commutative algebra** Dr. Manoj Kummini, CMI This expository talk by Dr. Manoj Kummini focussed on the Ring theory and explained how every commutative ring of prime characteristic p has the Frobenius endomorphism $F : r \mapsto r^p$. This, he said, can be used to study singularities of (the prime spectra of) such rings. In this session, Dr. Manoj described a class of such singularities, called F-rational rings, a notion closely related to rational singularities over complex numbers.
3	***March 10, 2021*** **Selmer companion modular forms** Dr. Sudhanshu Shekhar, Department of Mathematics & Statistics, IIT Kanpur Dr. Sudandhu Sekhar presented the joint work of Somanth Jha and Dipramit Majumdar, and it focussed on Selmer companion modular forms.
4	***February 24, 2021*** **Deep Learning for Automated Ocean Feature Extraction from Satellite Images** Dr. Deepak Narayanan Subramani, Department of Computational and Data Sciences, IISc Bengaluru Dr. Deepak Narayanan Subramani rationalized how digitization of synoptic ocean features could help in climate studies and forecasting ocean-atmosphere systems. He outlined how this was done through a time-consuming manual process by skilled human operators in the past. The dynamics-inspired deep learning system that Dr. Subramani's research team has worked on and developed, extracts satellite images of sea surface temperatures and sea-surface heights and allows predictions with about 70-80% accuracy.

5	***February 10, 2021*** **Stabilized Variational Multiscale Sub-Grid Finite Element Analysis of Coupled Brinkman-Stokes-Transport Model** Prof. B. V. Rathish Kumar, Department of Mathematics and Statistics, IIT Kanpur Prof. Rathish Kumar began this lecture with an introduction to the concept of variational multiscale Sub-Grid Finite Element Method for fluid flow problems and went on to explain the notion of apriori and aposteriori error analysis for the Finite Element Method, in the context of transport models with variable diffusivity. He further explained the theory of stabilized Variational Multiscale Sub-Grid Finite Element Method (VMSGFEM) for transport equations, which is especially helpful to handle convection dominated fluid flows. Prof. Rathish Kumar ended the lecture with a discussion on the VMSGFEA for the unified Brinkman-Stokes/Transport Model, and the results from the numerical test cases.
6	***January 27, 2021*** **Mixed-precision subspace iteration algorithm for large-scale nonlinear eigenvalue problems towards quantum-mechanical modelling of materials** Dr. Phani Motamarri, Dept. of Computational and Data Sciences, IISc Bangalore Dr. Phani Motamarri's research focus includes Computational Materials Physics, Computational algorithms for ab-initio material modelling at extreme-scale, Machine learning for materials design, High-performance computing, Computational solid mechanics, Finite-element methods, open-source code development using finite-elements for density functional theory (DFT-FE).
7	***December 02, 2020*** **Finite Element Computations of Free surface and Multiphase flows with Surfactants** **Dr. Sashikumaar Ganesan, Dept. of Computational and Data Sciences, IISc Bangalore** Dr. Sashikumaar Ganesan in this talk explained why computations of free surface and two-phase flows are very challenging, in particular, when surface-active agents (surfactants) are present in the fluid. He went on to describe how Marangoni forces are induced and how the existence of surfactants in fluids strongly influences the dynamics of the flow. Dr. Sashikumaar presented a finite-element scheme based on a coupled arbitrary Lagrangian-Eulerian and Lagrangian approach to compute free surface and interface flows with soluble surfactants.
8	***November 05, 2020*** **A study on Navier Stokes equations with Navier-slip boundary conditions** **Dr. Subha Pal, Tezpur University** Dr. Subha Pal started with a short overview of Navier-Stokes equations and different boundary conditions, and progressed to discuss the existence and uniqueness of solutions to the Navier-Stokes and damped Navier-Stokes equations subject to Navierslip boundary conditions in R3. He then went on to explain the Rothe method to prove the existence of weak solutions of the damped Navier-Stokes equations subject to Navierslip boundary condition with nonlinear source term in a bounded domain. The talk ended with a discussion on their future research plans.

9	***November 04, 2020*** **Central Limit Theorem, Moderate and Large Deviations for Nonlinear Stochastic Dynamical Systems** Dr. A. Haseena, Government College Chittur, Palakkad Dr. Haseena's talk centred around the Large Deviation Theory, a branch of probability theory which studies the exponential decay of probabilities of rare events. In the first part of this talk, Dr. Haseena discussed the Freidlin-Wentzell type large deviation principle (LDP). The next part of her talk focussed on her future work - formulate a SIRI-PDE epidemic model and prove the global solvability results in both deterministic and stochastic framework. The main objective of this research is to predict the time to extinction of epidemics falling under SIRI category.
10	***November 03, 2020*** **HOC Approach to the Dynamics of Wave Patterns in Excitable Media** Devanand, Ph. D.. scholar at IIT, Guwahati In this talk, Devanand briefly described a part of his thesis work where he has explored the dynamics of wave patterns of the excitable media. His work is mainly concerned with High Order Compact (HOC) simulation of spiral waves in excitable media, particularly the study of spiral wave dynamics.
11	***November 02, 2020*** **Complementarity problems and non-cooperatives games** S. Gokulraj, CUTN This talk was presented by Gokulraj, a research scholar at CUTN
12	***October 28, 2020*** **Differential quadrature parallel algorithms for solving system of convection-diffusion-reaction models** **Numerical simulation of blood flow in the aorta** V. S. Aswin V.S. Aswin presented two talks. The first one introduced three numerical schemes based on differential quadrature formulations for solving the system of convection-diffusion-reaction models. The second talk described how Computational Hemodynamics, provides clinicians sufficiently accurate diagnosis of cardiovascular disease, and guides them in the choice of optimal treatment methodologies.
13	***October 22, 2020*** **Dynamics of Distal Actions on Certain Compact Spaces** Alok Kumar Yadav, IISER-Mohali
SEMINARS AND TALKS **Talks By International Experts**	

	March 03, 2021 **Semiglobal optimal Feedback stabilization of autonomous systems via deep neural network approximation** Dr. Karl Kunisch (RICAM, Linz & Uni Graz, Austria) The presentation explored the joint work of Dr. Karl Kunisch and his research team with Dr. Daniel Walker. This collaborative research analysed a learning approach for optimal feedback gains for nonlinear continuous time control systems. The goal of the study was to establish a rigorous framework for computing approximating optimal feedback gains using neural networks. Dr. Karl explained how the approach rests on two main ingredients. First, an optimal control formulation involving an ensemble of trajectories with 'control' variables given by the feedback gain functions. Second, an approximation to the feedback functions via realizations of neural networks. Based on universal approximation properties they proved the existence and convergence of optimal stabilizing neural network feedback controllers.
	November 11, 2020 **First and second order shape optimization based on restricted mesh deformations** Dr. Roland Herzog (TU Chemnitz, Germany) Dr. Roland Herzog explained how in shape optimization problems involving partial differential equations, the domain is often represented by a computational mesh, and the optimization proceeds by repeatedly updating the mesh node positions. It is well known that such a procedure eventually may lead to a deterioration of mesh quality, or even an invalidation of the mesh, when interior nodes penetrate neighbouring cells. Dr. Roland examined this phenomenon, which can be traced back to the ineptness of the discretized objective when considered over the space of mesh node positions. As a remedy, they proposed a restriction in the admissible mesh deformations, inspired by the Hadamard structure theorem. First and second order methods were considered in this setting. Numerical results showed that mesh degeneracy can be overcome, avoiding the need for remeshing or other strategies.
	WORKSHOPS
	May 22, 2020 **NCM Workshop on Complex Fluids and Liquid Crystals** The mathematics of complex fluids and nematics is broad and rich, spanning multiple branches of mathematics such as calculus of variations, nonlinear PDEs, numerical analysis, topology, stochastic analysis and scientific computation. The training school was structured to be a set of introductory courses to the mathematics, modelling, analysis and applications of complex fluids and nematic liquid crystals.
	CMIT Events
	November 04, 2020, **The beautiful mathematics of H. Furstenberg and G. A. Margulis** Prof. Anish Ghosh, School of Mathematics, Tata Institute of Fundamental Research (TIFR), Mumbai This interactive session by Prof. Anish Ghosh was dedicated to the two living mathematical stalwarts who won the Abel Prize 2020. He described in detail the pioneering work of these mathematicians and their invaluable contributions to mathematics.

INSTITUTE EVENTS

The year 2020 was a year that had most of us locked indoors and none of the events could be conducted with the usual fervor and enthusiasm that mark these celebrations. Nevertheless, we used technology and stayed connected virtually, right through the pandemic.

1. June 05, 2020 – World environment Day

The pandemic and the ensuing lockdown did not allow for any big celebration of the World Environment Day at IISER TVM this year. It was a low-key event marked by planting trees in specific locations around the campus. Prof. J. N. Moorthy, Director, Prof. Srinivasa Murty, PICA, Prof. R C Nath, Prof M.P. Rajan, Dr. Hemalatha Goldwin and some other members of the Unnat Bharat Abhiyan participated in the event

2. June 21, 2020 – International Day of Yoga

This year, very aptly, the theme for event was 'Yoga @ Home' and 'Yoga with Family'. A short video prepared by the Yoga and Gymnasium Trainers of IISER TVM was shared with the entire IISER community, encouraging students, faculty and administrative staff to practice Yoga for self-improvement, for healing the body and mind and staying healthy and fit through the pandemic.

3. September 28-October 02, 2020 – 150th Birth Anniversary of Mahatma Gandhi

This week-long festival was inaugurated by prof. J. N. Moorthy, Director, IISER TVM on September 28, 2020. The celebrations were marked by screening 2 movies, 'Gandhi' on September 28, 2020, followed by a movie review of the movie on September 29, 2020. The movie, 'The Making of The Mahatma' and was screened on September 30, 2020, followed by a review on October 01, 2020. The week-long celebrations concluded on October 02, 2020, with an online discussion on 'How the movies portrayed Gandhi's ideologies' and a movie review competition about the movie Gandhi (1982).

4. October 27 – November 02, 2020 – Vigilance awareness Week

The Vigilance awareness week is observed every year to create an awareness among all stakeholders and citizens the need to collectively participate in preventing, and fighting corruption in all areas of governance and every day life. The theme for this year was "Vigilant India Prosperous India". The observance of the week started with the Director, Prof. J.N. Moorthy taking the Integrity pledge.

5. November 26, 2020 – Constitution Day

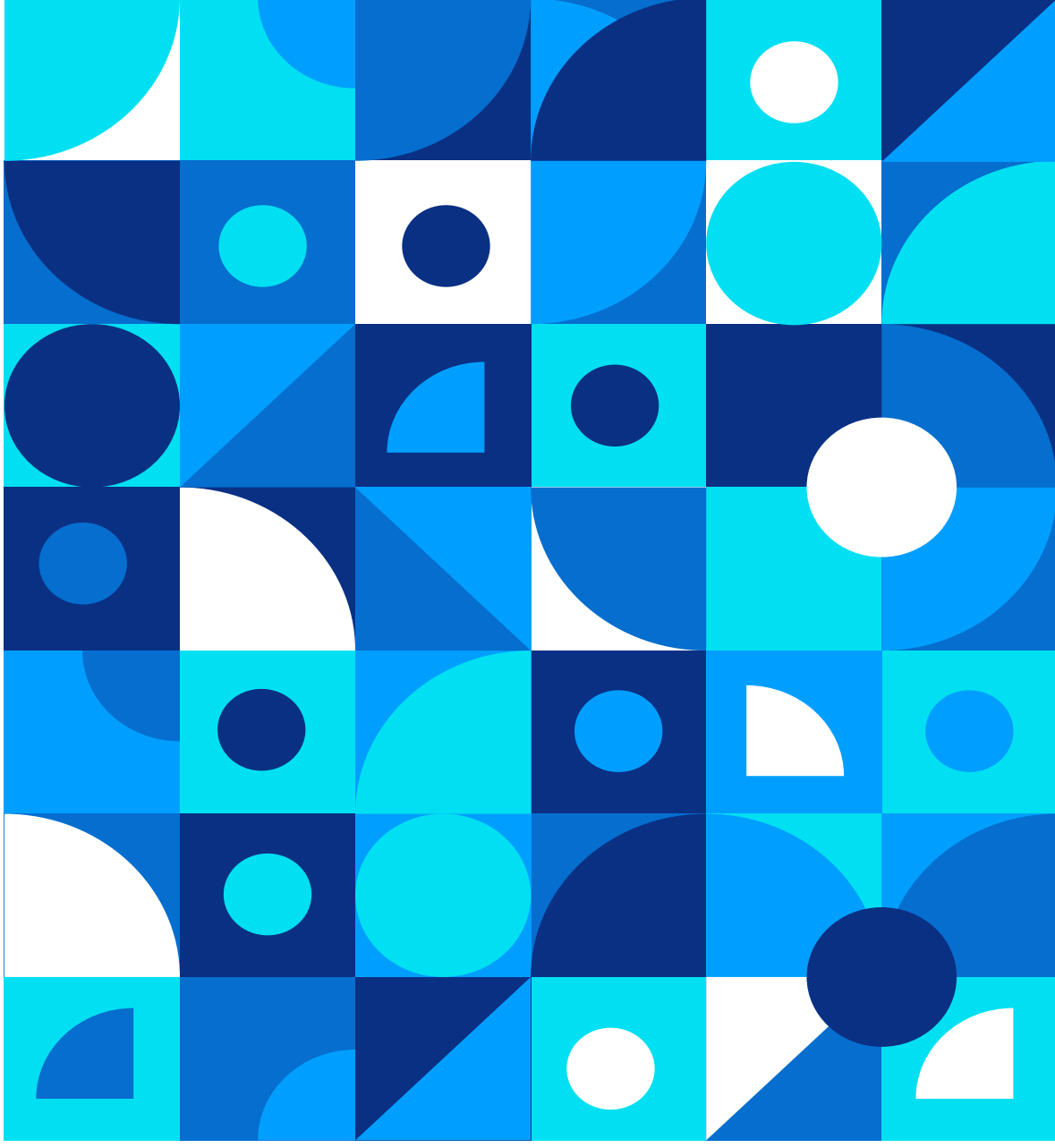
In 2015, The Government of India by a Gazette Notification declared 26th November as Constitution day. Samvidhan Divas or Constitution Day is also known as National Law Day and is celebrated across India to commemorate the adoption of the Constitution of India. The Director and all members of the IISER Fraternity read the Preamble of the Constitution to mark the celebration.

6. January 26, 2021 – Republic Day

IISER TVM celebrated the 72nd Republic Day with the students, faculty and administrative staff of the Institute. The Director, Prof. J. N. Moorthy hoisted the national tricolour and addressed the student community, encouraging them to give their best at all times. The Director was happy to inaugurate and hand over two new facilities, the Student lounge and the Student Recreation Centre to the students. As part of the celebrations, the IISER TVM chapter of SPIC MACAY arranged a flute recital by Shri. Shashank Subramanyam, accompanied by Shri. Nagai Sriram on the violin and Patri Satish Kumar on the mridangam, and was followed by an interactive discussion session. The entire event was live streamed for the benefit of all those who couldn't be on campus to participate in the event because of travel restrictions.

7. February 28, 2021 – National Science day

The National Science Day is celebrated to honor and commemorate the discovery of the Raman Effect by Prof. C.V. Raman, for which he was awarded the Nobel Prize in 1930. IISER TVM was privileged to have Dr. Thirumalachari Ramasami, former Secretary of the Department of Science and Technology, a globally acclaimed scientist and a technocrat par excellence, deliver the National Science Day speech, "Discovery to Ground Breaking Science".



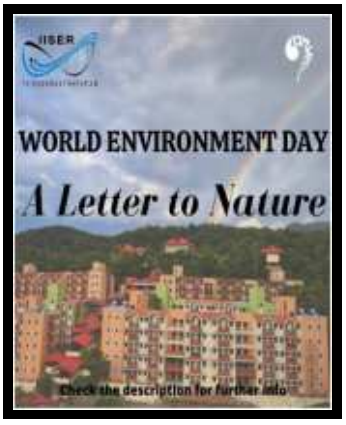
STUDENT ACTIVITIES

SCIENCE AND TECHNOLOGY COUNCIL (STC)

Ecological Society of IISER TVM (ESI)

The STC in collaboration with the Ecological Society of IISER TVM (ESI) conducted multiple online events to stay connected during the pandemic.

World Turtle Day is celebrated, across the world, on May 23 every year to raise awareness about turtles and find ways to ensure their habitats are not aimlessly destroyed due to ignorance and indifference of humans . On May 26, 2020, four students from IISER TVM, Awanti Shastri, Rutika Sansaria, Anumit Saralkar and Gokul Prabhu interviewed Dr. Kartik Shanker, Associate Professor at the IISc., Bangalore, who not only explained the need for protecting turtles, but also provided valuable insights into practical conservation measures to protect them.



World Environment Day was celebrated at IISER TVM on June 05, 2020. A letter writing competition was held where students were asked to address a 'Letter to Nature'. While only 6 entries were received for this competition, more students came forward to record their views and opinions on nature conservation, in a video jointly produced by the ESI and the STC. Shreya Venkatesan, Vishwathiga Jayasankar, and Deepthi Nambiar were declared winners of the 'Letter to Nature' competition.

Global Tiger Day is celebrated annually on July 29 to highlight the increasing threats to the natural habitat of tigers and the urgent conservation measures that are deployed to protect this magnificent wild cat from extinction. Dr K. Ullas Karanth, a zoologist and a Tiger expert from Karnataka gave a talk on how the COVID-19 pandemic has affected research and study of tigers.

World Animal day was celebrated on October 04, 2020 with ESI and QSI hosting a Wildlife quiz through Google Meet. The quiz was jointly hosted by Vidyarashmi Hanehalli (B19), Naveen Balachandran (B19), and Anumit Saralkar(B17).

Night on Earth – documentary series

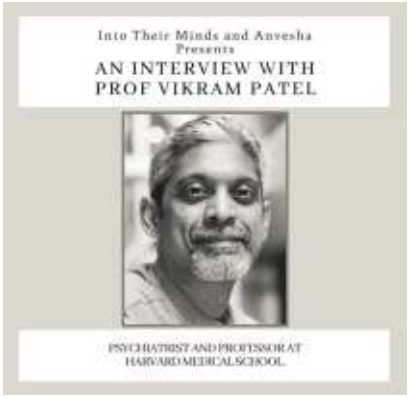
The ESI screened the breathtakingly beautiful documentary series 'Night on Earth'. The documentary captured on camera, the less-known beauty of the nocturnal world. The documentary was made using state-of-the-art equipment like IR, low-light, night vision, heat-seeking cameras that turned the darkness of night into rich, vivid colors. The first episode titled 'Moonlit Plains' was screened on March 19, 2021. Two other episodes, 'Frozen Nights' and 'Jungle Nights' were screened in the month of April 2021.

Proteus Talks of the Biology Club of IISER TVM

On November 14, 2020, as part of the Faculty Talk Series of Proteus, Dr. Katrina Fernandez, a renowned Ecologist and Director of Wild Otters Research Pvt Ltd., presented a lecture on the Smooth-Coated Otter, its ecology and behavior, and the field methods employed in the study of otters.

Into Their Minds (ITM)

In the earlier editions of 'Into Their Minds', eminent personalities shared their professional achievements, the focus of their studies/work, and also discussed to some extent, the effect of the pandemic on the environment and communities. In the more recent editions, the focus shifted almost completely to the pandemic and how it has affected lives of researchers across nations. We heard from Sreelekshmi M, Vaishak Jayadevan, Nadi Dixit, all former students of IISER TVM, currently pursuing doctoral or post-doctoral studies in foreign universities, what they did to stay focused and connected right through these unprecedented times.



Outreach Activities

The STC partnered with the Unnat Bharat Abhiyan (UBA) wing of the Institute and organized online lecture sessions for students residing in the small villages/ hamlets around the campus. The lectures delivered by students of IISER TVM not only focused on the board portions but also taught other interesting concepts and topics in a fun way. Lab sessions were hosted by Ph. D. students and entire experiments were video recorded and shown to students. There were a minimum of 50 students who attended each of these lecture sessions. Regrettably, the STC was unable to record more than 3-4 lectures due to time constraints. The Council looks forward to working with UBA in the future for such outreach events.

Anvesha- The Science Fest 2020

Anvesha, the Science fest of IISER TVM, is conducted under the auspices of the Science and Technology Council (STC) of the Institute. This year, due to the raging pandemic, we were constrained to conduct the fest online. Anvesha 2020 was conducted in the second week of October 2020 and was fully sponsored by Sabari Scientific Lab Supplies. Undoubtedly, a live session would have been ideal, but we were equally pleased with the keen interest and good participation in the online events.

Six of the eight major events organized as part of Anvesha 2020 were intercollegiate events, while two events were restricted to IISER TVM students alone.

Intercollegiate Events

1. Crime Scene Investigation
2. Resenseo
3. Inquisitio 2.0
4. CodeBattle
5. Science in Canvas
6. Nobel Lecture Series

IISER Events

1. Potpourri
2. BahFest

Crime Scene Investigation (CSI)

The criminal mind is a labyrinth of lies and deception, but the STC of IISER TVM believes that any crime can be solved using science and the art of deduction. CSI is an intercollegiate event, contestants are given make-believe mystery cases to solve within a stipulated time frame. CSI was conducted on a discord sever as there were 75 teams (4 members per team) from as far as Assam, Tripura, Delhi, Pune, Manipal, Tirupati who participated in this year's event, in addition to participants from all across Kerala. The event was conducted in two stages. The preliminary round was conducted on October 17, 2020 where contestants had to decode 2 mystery stories in 5 hours. Ten teams graduated to the finals that was held on October 25, 2020, where contestants had to solve a time-evolving story in 5 hours.

Resenseo

This is IISER TVM's scientific review writing competition that is open to students all across India. Contestants had to choose one scientific paper from any discipline, from the 3 scientific papers provided to each discipline, and write a complete review of the paper in about 800 words or less. There were 46 registrations from across the country for this event.

INQUISITIO 1.0

The Treasure Hunt game of IISER TVM was conducted for the first time as an online event, with participation restricted to students of IISER TVM. The preliminary round had 60 teams (2 members in each team), participate in the event that was held on May 23, 2020. The competition among the teams was so intense that a tie breaker round was needed to select the top 5 teams that played the finals held on June 07, 2020. The competition among the finalists was ever so frenzied that only a few seconds separated the winners and runners-up. The winners received a cash award of INR. 1000.00 and the runners up were awarded INR. 500.00

INQUISITIO 2.0

Inquisitio 2.0 was hosted as an intercollegiate event. Students from research institutes, engineering, medical and regular degree granting colleges, covering several geographical boundaries, actively participated in the competition. The event was conducted on a discord server to accommodate the 108 teams (each team consisted of a maximum of 3 members) that participated in the competition. Two rounds of preliminaries were conducted on September 20, 2020. At the end of the first preliminary round, 30 teams qualified to the second preliminary round. At the finish of the second preliminary round, 6 teams that cracked the challenge within the stipulated time were selected to play the finals, that was conducted on October 24, 2020.

The final event was intensely interactive and exciting, with each team being assigned a coordinator. This was an exceptional virtual treasure hunt with only a limited number of clues and codes hidden at various locations spread across different continents. It also had an interesting storyline, giving the finalists the feeling of playing a real-time treasure hunt. The winning team completed the event in 2.5 hours. There was fierce competition among three teams for the runner-up position that multiple tie breakers were needed to decide the winner. This event was a huge hit and one that received several congratulatory messages and enthusiastic feedback from participants.

CodeBattle

Coding has become an essential part of many scientific studies. CodeBattle is IISER TVM's coding competition that is open to programmers from across state boundaries providing them a platform to demonstrate their coding/programming skills. This event was hosted on Hackerrank, and had 75 registrations from higher education institutes in Kerala, Mumbai, Pune, other IISERs, IITs, NITs and engineering colleges.

Nobel and Abel Exposition Series

A Nobel Lecture Series and Abel Prize Talk was organized as part of the fest in collaboration with the various clubs of IISER TVM, from October 19-24, 2020. Four faculty members from IISER TVM and one from IISER Bhopal gave a talk on the Nobel Prize (and Abel Prize) that were awarded in 2020. The talks were hosted through Google Meet and was also live telecast on YouTube to allow for wider participation in the event.

BAHfest

BAHFest is a contest that requires contestants to present vague, unproven, and funny scientific theories (Ad-hoc hypotheses) with the same focus and sincerity as serious scientific study. The hypothesis must be thoroughly researched, well-argued and presented with graphs, data, mathematics, visuals, citations, and other aids. Participants are expected to defend the hypothesis convincingly and answer all questions posed by the audience. The hypothesis titled 'Yawning: The Future of Communication' by Gayatri Kandapal and team (IPHD 20) won BAHFest 2020.

Potpourri

This is a fun online contest, with mind-bending rebuses, riddles, anagrams, crosswords, and puzzles to solve. Potpourri was co-hosted by Joel Parkadavil and Ravikiran Hegde (both from B'19) and had more than 40 teams participating in the contest

Science in Canvas

This year STC introduced a new event, ‘Science in Canvas’ that required participants to express science through comics, posters, infographics, and photographs. The theme for the contest was "Time and Life". The entries were judged by Ipsa Jain, a notable science illustrator. Arunima Mathew, IISER TVM, won the first prize for her picture titled ‘Life in Spacetime’. The second prize was given to Apurva Saha, IISER Pune for ‘Sound of the Big Bang’

(Arunima Mathew)

Runner-up : Sound of the Big Bang by Apurva Saha, IISER Pune

Exhibit A

The first edition of Exhibit A, the monthly science newsletter launched by the Science and Technology Council of IISER TVM was released in September 2019. Ever since, students of the Institute have used the newsletter as a platform to express their views about science through various creative media. Each issue of the newsletter includes an interview with a scientist from IISER TVM or from other research institutes, explaining their research focus and drawing attention to their research findings. Audio recordings of these interviews have been posted to SoundCloud.

Ira Zibbu, the current editor-in-chief, heads a 20 member team that includes writers, editors, illustrators, designers, and media editors. Students outside the content creation team are also encouraged to submit photographs, cartoons and comics to the newsletter. The Exhibit A issue of March 2020, included an informative pamphlet on COVID-19 that helped spread awareness about the novel disease. The subsequent issues focused on a variety of topics ranging from olive ridley turtles, brain’s immune cells, LGBTQ community, disability awareness, competitive evolution in medicine, mental health, impact of the pandemic on scientific publishing, trajectory of science for 2021, gender bias in academia and ecofeminism among others. The newsletter has an ongoing series ‘Lab Feature’ that showcases the labs at IISER TVM. The newsletter has permanently moved to the website in an upgraded and appealing HTML format, and is now accessible to external subscribers as well.

Exhibit A

Collaborative work

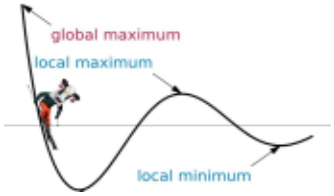
A network of all seven IISERs, CEBS, NISER and IISc has been created to improve communication and increase collaborative activities among these premier higher education institutes spread across the country to spark research in new and emerging frontiers of science and technology. Inter-institute activities were planned from the month of February 2021

Quizzing Society of IISER TVM (QSI)

The QSI organized a general quiz on February 12, 2021 that was hosted by Ira Zibbu (B19). The preliminary round was open to everyone, the best teams made it to the finals and battled through several rounds of questions.

Rebus Puzzle Competition

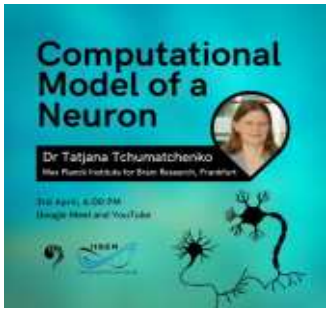
A rebus puzzle combines the use of illustrated pictures with an individual or group of letters to depict words and/or phrases. The competition was held on March 01, 2021 that had a completely captivated audience. Thigazholi.M and Shravan, along with Siddharth Murali and Sudhanshu Dimri aced the contest.



International Day of Women and Girls in Science is celebrated on February 11 every year. This year, as part of the celebrations, Dr. Poonam Thakur from the School of Biology, IISER TVM delivered a talk titled "α-Synuclein fibrils induced disruption of pacemaker firing in dopamine neurons is dependent on selective K-ATP channel activation". Starting with a brief overview of Parkinson's disease, Dr. Thakur explained the latest developments and research in understanding the cause and cure for Parkinson's disease.

Breakthrough Series

This series of lectures focused on some of the significant discoveries made in the year 2020. Dr. Nisha Kannan, Dr Suvrat Raju and Dr Shriharsh Tendulakr delivered the talks to an engaging audience. However, due to technical issues, the lecture by Dr Tatjana Tchumatchenko was cancelled.



Pi day celebrations:

Every year, 14th March is celebrated as Pi Day. As part of the celebrations, an intercollegiate competition titled "What's Your Share of Pi" was organized. Contestants were asked to devise a new experiment that could accurately estimate the value of Pi and submit a detailed write up on the new experiment. Dibyajyoti Mech from IISER Kolkata won the first prize and the runner up was and Asmi Gaikwad from IISER Pune.

Astrobio:

'Astrobiology' was the general theme of all the activities organized, throughout the semester, by Parsec and ESI in collaboration with the STC . Six research scientists from various reputed institutes delivered talks on various aspects of Astrobiology. Additionally, an art competition, a debate, a memecon along with a unique contest "A Message from Humanity" - themed on the Golden Record sent by the Voyager probes was also conducted.

Winning entries of the art contest by Riya Sheokand and Dheeraj Chandavarkar

SPORTS COUNCIL

The Vasanth semester saw sporting events take an upward swing as more and more students returned to the campus. The events were continuously monitored to ensure that all necessary COVID protocols were meticulously followed. The events hosted were mainly league and farewell matches for the outgoing 2016 batch of BS-MS students.

GIRLS FOOTBALL FAREWELL MATCH

The girls' farewell match was held between Batch 16 and the Rest of IISER. It was a fiercely contested game and Batch 16 emerged as winners, based on a penalty shootout.

IISER BASKETBALL LEAGUE (GIRLS)

Three teams competed in the IISER Basketball League matches for girls. All 3 teams consisted of players from different batches. Each team played two matches. The finals of this event could not be conducted due to the COVID restrictions imposed throughout the state. The winner and runner-up was decided based on points scored in the earlier 2 games that were played.

VOLLEYBALL FAREWELL MATCH (GIRLS)

The girls' volleyball farewell match was held between Batch 16 and the Rest of IISER. The winners were the Rest of IISER team.

INTER-BATCH CRICKET TOURNAMENT

The inter-batch cricket tournament is generally held to get participation from second year students. Four teams participated in the inter-batch cricket tournament, while 3 teams had students from the BS-MS batch, the fourth team had only Ph.D. and I-Ph.D students. The finals was played between the Batch 16 and the Ph.D. teams. Batch 16 team were declared winners of the tournament and the Ph.D. team were the runners-up.

INTER BATCH VOLLEYBALL (BOYS)

The inter-batch volleyball match for boys had 6 teams competing against one another for the winners' title. Batch 16 -A, headed by Girish were the winners of this match, and Batch 16 -B headed by Aman Rastogi were the runners-up.

IISER FOOTBALL LEAGUE (IFL)

Interested players came together and formed four teams. The matches were played in the true spirit of the game, with every team giving their best. The finals could not be conducted due to unexpected COVID related developments across the state. In recognition of their efforts, players received the following awards

- Golden Boot award - Rejith Raj of Batch17,
- Golden Glove 2020-2021 award - Varun of Ph.D.
- Emerging Players' - Aravind and Bazil of Batch 19
- Rithwik of Batch 16 had the most assists

IISER BASKETBALL LEAGUE (BOYS)

Four teams, Blue Mangoes, Team Swish, Flat Earth All-Stars Revenge and Sweet 16, played the IISER Basketball league matches. While 3 of these teams had students from multiple batches, Sweet 16 consisted of players from Batch 16 only, and they walked away with the winner's title. Flat Earth All- Stars Revenge were the runners-up.

CHESS

The Chess Welcome Tournament was an inter-batch event. Batch 18 emerged as winners of this tournament with a score of 4.5 out of 5. The runners-up title was shared by Batch 17 and Batch 19, each scoring 3.5 out of 5.
IISER-TVM's first online Chess tournament, Blitz, was also held this year. At the end of seven rounds, Akhilan E.M. was declared winner and Anand. M.P. the runner-up.
Tony Nixon Mavely was the winner, and Jeetnet the runner-up, at Blitz 2.0.

IISER BADMINTON LEAGUE

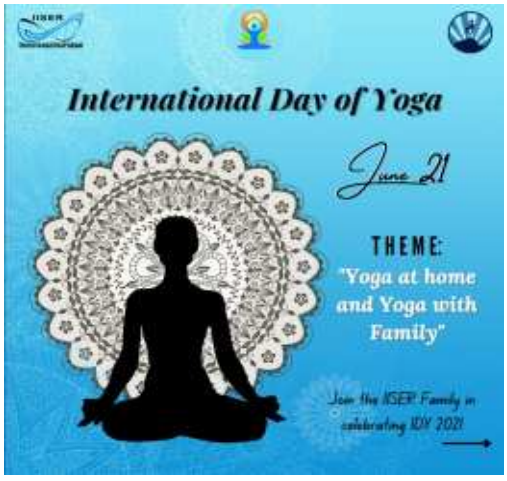
The badminton league matches could not be completed due to COVID related disruptions across the state of Kerala.

TABLE TENNIS TOURNAMENT

The Table Tennis tournaments were divided into three categories - Women's singles, Men's singles and Men's doubles.
Women's singles - Winner – Hariny (Batch 17); Runner-up – Preethi (Batch 19)
Men's singles - Winner – Keshav (Batch 16); Runner-up – Chetan (Batch 16)
Men's doubles - Winner – Keshav, Chetan and Sanchit; Runners-up – Samrat, Ramakrishna Patra and Ramakrishna Biswas

SAHASRARA 2.0

This year too, the yoga competition had to be conducted online due to COVID restrictions. Students and faculty participated in Sahasrara, the online yoga competition that was judged by IISER TVM's yoga instructor, Dr. Athira Arun, BNYS. Arshia M.K of Batch 20 was declared winner in the student category, and Dr. Tanumoy Mandal was the winner from among the faculty.



CULTURAL COUNCIL

Ek Bharat Shreshtha Bharat (EBSB)

The Ek Bharat Shreshtha Bharat (EBSB) program for Varsha 2020 was conducted completely online. Various events were organized every month in collaboration with different sub-societies under the Cultural Council.

In July, the Dance Society put together a dance loop featuring classical dance forms of Southern India. The video which featured a beautiful blend of various dance forms such as Kuchipudi, Mohiniyattam, Bharatanatyam, and Kerala natanam, was uploaded to the official Instagram account of the Cultural Council

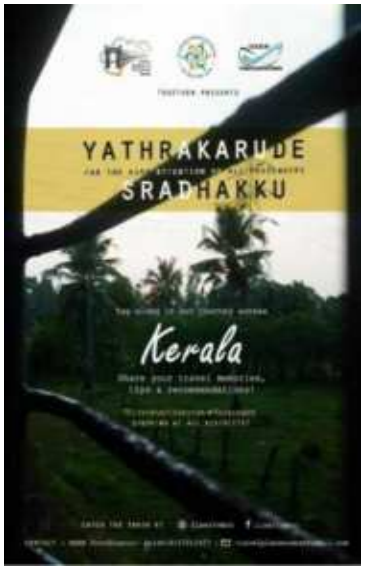
The Quizzing Society of IISERTVM (QSI) and the Cultural council put together a quiz competition on August 16, 2020 titled 'India Quiz' which was enthusiastically received by students. The Quiz Masters Tony Nixon Mavely and Siddhartha Yaddanapudi posed questions relating to all the states of India, that assessed the contestants' knowledge of Indian culture, traditions, historic monuments and events, social practices, sports, accomplished personalities, science, philosophy, traditions and achievements.

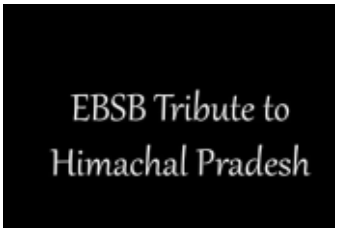
A virtual travel planner 'Yathrakarude Sradhakku' (For the kind attention of passengers) was announced on August 15th in collaboration with the EBSB team at IIT Mandi. The planner, had two parts, a social media engagement component and the travel brochure. The social media engagement event began in August via the official Instagram account of the Cultural Council. Every week, a district of Kerala was chosen and students shared articles, photographs, etc. of their most favorite spots, unforgettable memories, and other information/suggestions that could be of use to a new traveler. IIT Mandi simultaneously begun the program featuring various places in Himachal Pradesh.

On September 27, 2020, Ms. Premila Sethumadhavan, an artist specializing in Kerala mural art conducted a webinar that featured a brief history of the art. She also described some of the finer techniques used in creating mural art

In November, IIT Mandi started a series titled "Knowing the unknown: from Himachal Pradesh" which was done in collaboration with the literature and fine arts society of the Institute. The series was curated by students and featured different art forms indigenous to Himachal Pradesh.

The social media aspect of the virtual travel planner was wrapped up on Instagram by end of December 2020. At the end of January 2021, a Himachali folk song 'Puche Amma Meri' was performed by the music club members as a tribute to the culture of Himachal Pradesh. The song beautifully portrayed the emotions of a mother for her children. This was posted on the official Instagram page of the music club of IISER TVM.





Ishya 2021

Ishya '21, the annual cultural fest of the Institute had a spectacular launch on 28th March. It began with an open mic and concluded with the official launch. In the following weeks, multiple events were announced, namely Lumera Obscura, VR-Ishya, Mandala Art competition and Snapscribe. However, all further activities were suspended owing to the worsening COVID-19 situation across the country. Ishya '21 witnessed a soft conclusion with two pro-shows of opposing nature, a musical performance by Heeral Chhatralia and a stand-up show by Sejal Bhat.

Dance Society

Instagram, one of the social media platforms of IISER TVM was buzzing with dance activity during the pandemic. Online solo dance performances, group dance competitions, and duet dance competitions were organized right from April 2020, on the Instagram page. In August, the Tarang team of Batch 15 portrayed a beautiful dance loop video and shared their experience of Tarang. The new semester kickstarted with an online duet dance competition, "Synergy: Be my mirror". Around 15 teams participated in the event that was judged by college alumni. Winners were announced on the Instagram page.

Throughout the year, on every Friday, between 6 pm and 7 pm students met online and studied different dance genres like hip hop, western, Bollywood, semi-classical, classical. Members of the society adept at different dance genres conducted these classes that included workout sessions as well.

In November, as a Diwali special, a Bollywood dance "Malhari" which was shot on the campus, was released through the Instagram page. The Dance Society also uploaded to Instagram "Don't Rush" and "Rasputin" reels. In addition to all these events, there was a loop dance by batch 20 and a quarantine special loop dance.





Music Club

The Music Club remained active right through the pandemic. A solo singing competition was conducted between April-May 2020. In August, an Independence Day tribute event was organized by batch 18 students. A Tribute to the legendary S. P. Balasubrahmanyam was organized in September 2020. The Music Club hosted an online Showcase event based on movie songs. It was gratifying to see the response of students to the online classes organized for classical Hindustani and Carnatic music.

Literature and Fine Arts Society

The Literature and Fine Arts society organized a number of events during the pandemic that helped students remain connected in spite of being physically distanced.

●A letter-writing competition, the 'CoViD Epistle Contest' was held in the month of April 2020. Students were asked to creatively express their lockdown emotions in a letter addressed to/or from the corona virus.

●An Instagram handle for the society '@isla.iisertvm' was launched in June 2020. Book reviews and weekly features titled 'Song of the Week' and 'Book of the Week' were introduced in the society's Instagram page.

●The Society also launched language tutorials in Hindi, Malayalam, and German. This was taught by the students proficient in these languages.

●An online drawing/painting competition was conducted between May-June 2020. In June, a science fiction short story writing competition was conducted, under the theme ' Terra Novus'.

●In June, in celebration of Pride Month, team Sopanam posted reviews of poems and films that proudly acknowledged all forms of love. A new logo was created for Sopanam, the annual institute magazine during the lock-down and the first edition of Sopanam 2020 was launched on August 10, 2020.

●In October, the Society celebrated a month-long online art event called Inktober@IISER. Students were given 31 prompts to describe Life at IISER TVM. The response of students to this event was very encouraging. A letter-writing competition was conducted on the occasion of Gandhi Jayanti. A logo-designing competition was conducted in

October, to shortlist a suitable logo for the society's social media handles. The Society conducted a short story writing competition on the occasion of National Unity Day.

●Remembering Stan: A fun riddle hunt was held in November as a tribute to Stan Lee, the legendary creator of Marvel Universe. This was a very popular event and the winners received an exclusive, illustrated collection of 'Avengers at IISER', that was crafted by the Sopanam team.

●The Sopanam team published an engaging futuristic recount of the eventful year 2020 titled, 'The year 9716 ce: 2020 A Review' .

●The Society also conducted tutorials for origami, water colour painting and digital art.

Movie Club

About 16 movies were screened over a period of 4 months in 2020. Favorite among these were the highly acclaimed movies like 'The Great Beauty' and 'Amour' and socially relevant films like 'Wadjda' and 'Portrait of a Lady on Fire'. These movies also generated considerable discussion among members of the Movie Club

The Movie Club organized a retrospective that focused on the works of the great Austrian auteur, Michael Haneke. The Club also hosted an online contest, 'Alternatino' on Instagram, where participants had to suggest alternative titles for famous films. Two movies were screened on Gandhi Jayanti, this was followed by discussions and review writing competitions.

Theatrics Society

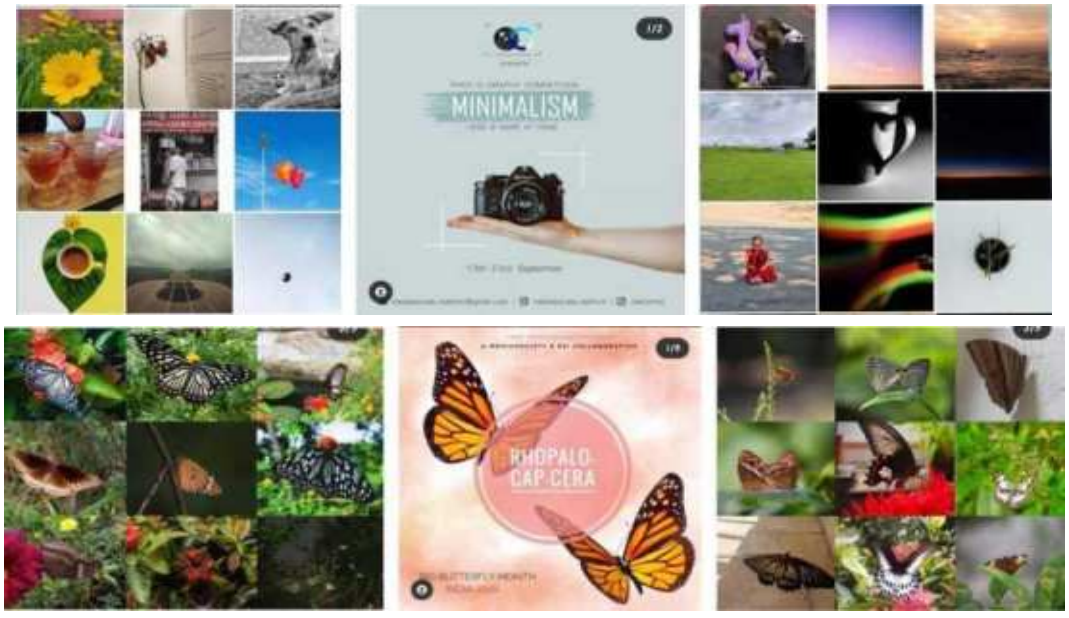
The Society conducted an online mono act competition that helped recognize students with a natural and dramatic flair for the theatrics.

Media Society

The logo of the Media Society was launched in September 2020. Subsequently, the Society announced a minimalistic photography contest, the central theme of the contest was 'Less is More' that challenged the photographer's ability to capture visually pleasing photographs of common everyday things. The 26 entries that were received were screened by alumni photographers and the winners announced in October 2020. There were 4 prize winning entries – one popular choice and 3 best winning entries.

In celebration of the Big Butterfly month (5th -20th September), a photography event titled "Rhopalo-cap-cera" was held in collaboration with the ESI. Photographers had to capture on camera the butterflies found in the campus and around their homes. All 36 entries that were submitted were featured as stories and posts on Instagram

Light through Lens was a photography event held in November as part of the Diwali celebrations. Students shared their celebrations from home and old memories from campus days, that were featured as stories on Instagram.



STUDENT WELFARE COUNCIL

MESS

The Mess at IISERTVM is a completely student-run enterprise, it has been so since 2013, and is one of the most successful student endeavors at the Institute. The Mess Committee and the SWC coordinate all activities of the Mess, including procurement of supplies, management of Mess staff, ensuring financial probity, stock management, planning of menu and disposal of waste. The Mess caters to the food needs of the entire population in the campus, all through the year. Additionally, the Mess Committee also manages 2 fully operational cafes that provide a variety of snacks, quick-eats, mini-meals at very affordable rates. The Mess was operational even during the pandemic, serving food to students and others who stayed back in the campus. The Mess Committee worked relentlessly to ensure that all COVID protocols were meticulously followed, and no one in the campus went hungry during the pandemic.

PLACEMENT AND ALUMNI AFFAIRS

The Career Development and Placement Cell of IISER TVM started functioning from October 2019. The SWC and student volunteers have been engaging with public and private research establishments, industry and academia to help graduating students find suitable placements. The SWC also maintains a database of alumni that allows students to interact with alumni and explore options for career development. They have brought out a Placement Brochure for 2021-22

MEDICAL CENTRE

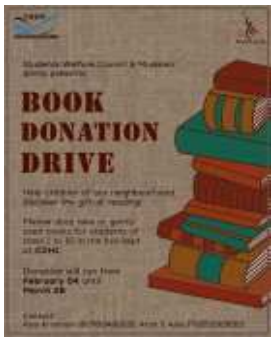
SWC conducted a blood donation camp in the campus on March 06, 2021 where 35 students voluntarily came forward to donate blood. This was a coordinated effort involving the Institute's Health Centre and the Sree Chithra Institute of Medical Sciences, Thiruvananthapuram. The camp was organized following all COVID 19 protocols.

STUDENT RECREATION CENTER (SRC)

Prof. J . N . Moorthy, Director, IISER TVM inaugurated the Student Recreation Center on January 26, 2021. The SRC has two game rooms, a reading room, a dance studio and a music room. The SWC under the supervision of two faculty coordinators manage the activities and the booking system of the SRC.

OTHER ACTIVITIES

A book donation drive was held at the Institute from February 04 to March 28, 2021 under the umbrella of the SWC and Muskaan, the social wing of the Cultural Council. Books donated by students were handed over to school children living in the villages surrounding the Institute.



Food Kit Donation:

The tribal families in Chathangode were severely crippled during the pandemic. The SWC and Ph. D. Charity raised funds to buy groceries, vegetables, and other essential items, packed them as food kits and distributed it among the families that were hard-hit by the COVID 19 pandemic. The entire IISER family contributed generously to this cause.

TV set donation:

The SWC in coordination with Muskaan donated a smart TV to the CSI Wills Boarding Home for Girls that has more than 50 girl children living there. This donation ensured that the young girls did not miss out on their online classes. It was the contribution from several of our students and faculty that made this possible.

The SWC is also responsible for keeping the student community updated on all COVID related guidelines that are in force and must be adhered to while in campus.

STUDENT ACADEMIC CLUBS

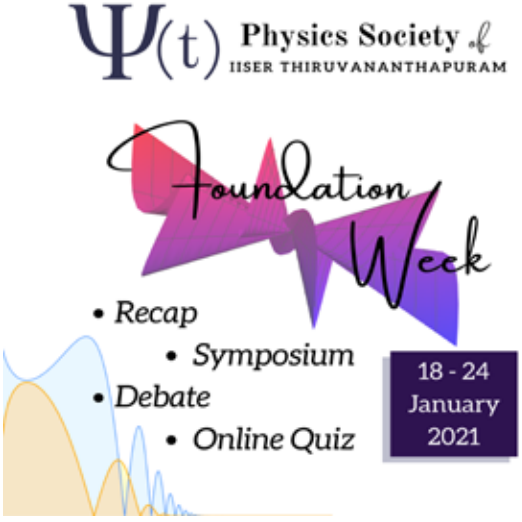
PHYSICS SOCIETY OF IISER TVM PSI(T)

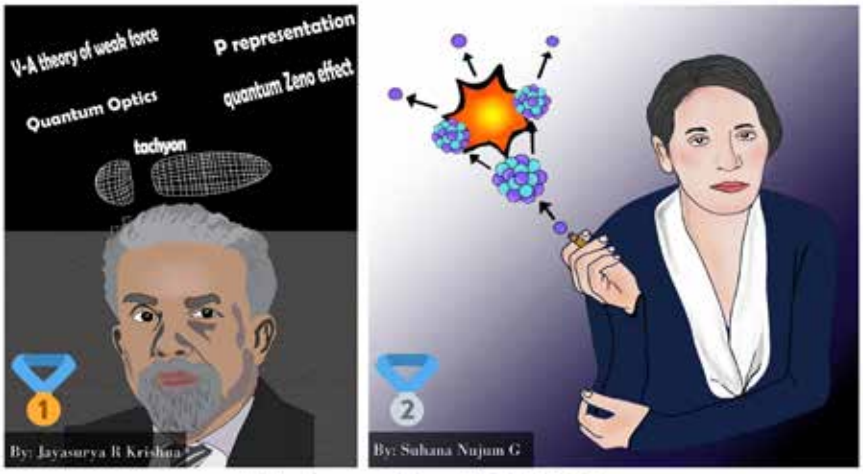
The Physics Society of IISER Thiruvananthapuram - PSI(T) is the Science Club of the School of Physics. This open community is administered by the School of Physics with the primary objective of promoting Physics among all students of the School, irrespective of their year or subject of study. The PSI(T) poses interesting and intriguing concepts and questions to students, that can only be worked through collective discussions and debates. The conversations, dialogues and consultations provide students a vibrant environment that leads to positive learning outcomes. Membership in the PSI(T) has been growing steadily over the months and plans are afoot for expanding the activities of the club.

Owing to the pandemic, most of the club's activities took place virtually. A brief overview of the activities is given below.

DATES	EVENTS
Foundation Week 2021	
Jan 18-24, 2021	The Foundation week celebrations continued from January 18-24, 2021. In addition to the webinar held in mini-symposium format, PSI(T) also hosted a debate and a quiz competition. Several students participated in the week-long celebrations.
Webinar	
Jan 18, 2021	Prof. Sunil Mukhi, IISER Pune
Jan 21, 2021	Dr. Tanumoy Mandal, IISER TVM
Jan 22, 2021	Dr. Joy Mitra, IISER TVM
Jan 23, 2021	Debate – Bhautik Dialectics 1.0
Jan 24, 2021	Science Quiz – Boltzmann Brains 2.0
Talk Series	

Faculty Talk Series	
Aug 27, 2020	Dr. Manik Banik, IISER TVM
Sep 16, 2020	Prof. Anil Shaji, IISER TVM
Dec 21, 2020	Dr. Rajaram Nityananda, Azim Premji University
Mar 02, 2021	Prof. Jutta Kunz, Carl von Ossietzky University of Oldenberg, Germany
Nobel Talk Series	
Oct 21, 2020	Dr. Soumen Basak, IISER TVM
Oct 21, 2020	Dr. Bindusar Sahoo, IISER TVM
Alumni Talk Series	
Dec 28, 2020	Jyotishraj N, Georgia Tech, Atlanta
Mar 26, 2021	S Mahesh Chandran, IIT Bombay Kanchan Soni, IUCAA Pune
Student Talk Series	
Nov 04, 2020	Subrabalan M, BS-MS Batch 17
Nov 10, 2020	Kartik Bhide, BS-MS Batch 17
Contests	
Nov 06, 2020	The PSI(T) hosted the fun-filled Physics themed quiz, Boltzmann Brains 1.0
Feb 26, 2021	An art contest PSI-ART 1.0 was conducted that uncovered the hidden artistic talents of PSI(T) members. The general theme of the contest was Physicists and their contributions.
Social Media	
	The PSI(T) has an active social media presence on Instagram and Facebook with more than 1000 followers. The content that is shared regularly on these two platforms is curated by the PSI(T). Future plans for wider outreach include setting up of a website and publishing a newsletter that highlights promising research from the School of Physics.





Winning entries of PSI-ART 1.0

CLUB OF MATHEMATICS, IISER TVM (CMIT)

With the resurgence of the pandemic, and the extension of lockdown, the only way to stay connected was through virtual mode. The discord server launched last year helped CMIT members actively engage and support one another, at various levels, during these uncertain times. The discord server was used to share ideas, hold discussions and help one another prepare for competitive exams like the CSIR NET. In fact, some of the students cleared the lectureship cut off for CSIR NET with the help, support and encouragement from fellow members.

Reading groups have been popular among CMIT members. This year, in addition to the reading groups for 'Probability Theory' and 'Category Theory' , CMIT organized 'The Reading Seminar Project' where students interested in a specific area of mathematics worked together on a directed reading course, under the guidance of a faculty member. There was a lull in this activity, with the start of examinations, though members are keen to resume the activity shortly.

CMIT Activities in 2020-21

DATE	TITLE	SPEAKER
TALK SERIES		
June 13, 2020	Finding solutions to mathematical equations — an informal walkthrough	Dr. Srilakshmi K, Assistant Professor, IISER TVM
Aug 17, 2020	Sudoku squares	Hitha PR, BS-MS 5th year student, IISER TVM
Aug 29, 2020	Category theory for beginners	Kalin Krishna, BS-MS fifth-year student, IISER TVM
Oct 24, 2020	Abel Prize Talk was organized in collaboration with 'Anvesha'	Nikita Agarwal, IISER Bhopal
Nov 04, 2020	The beautiful mathematics of H. Furstenberg and G. A. Margulis	Anish Ghosh, TIFR Bombay
Nov 20, 2020	Some applications of cube roots of one	Prof. Neil Dummigan, University of Sheffield, UK

DATE	TITLE	SPEAKER
Nov 27, 2020	The Road to Henstock–Kurzweil Integrals	Aakash Gupta, I-Ph. D. first-year student, IISER TVM
Jan 07, 2021	An introduction to the theory of nonlinear elliptic	Dr. Dhanya Rajendran, Assistant Professor, IISER TVM
Jan 16, 2021	Diophantine equations that moved mathematics – this talk was organized in collaboration with the Math club of IISER Berhampur	Prof. Preda V. Mihăilescu, Mathematisches Institut, University of Göttingen, Germany
Jan 26, 2021	On the spectral radius of bi-block graphs with given independent number α	Joyentanuj Das, Ph. D. Student, IISER TVM

OTHER ACTIVITIES

May 12, 2020 - Women in Mathematics
The documentary 'Secrets of the Surface' by George Csicsery was screened to commemorate the life and mathematical work of Maryam Mirzakhami. This was followed by a discussion on women in mathematics, the celebrations came to an end with a half-day quiz about women in mathematics.

Aug 2020 -Mini-course
Praphulla Koushik, Ph. D. Student, IISER TVM conducted a Mini-course on CW complexes

Sep 05, 2020 - Ice Breaker Session
CMIT hosted an Ice breaker event for the BS-MS B18 and I-Ph. D. /Ph. D. 2020 Students, the new batches of the Math department

Sep 26-27, 2020 - S2 Mini-Symposium
A Mini-Symposium was organized on Sept 26 and 27, 2020 to celebrate the 2nd anniversary of CMIT. The 6 talks were spread over two days, speakers at the event included 3 faculty members and 3 students.

Nov 22 – 26, 2020
Komma Patali, a Ph. D.. Student of IISER TVM presented a series of 3 Lectures on 'Group Theory'

Mar 14, 2021 - Pi - day
Pi – Day was celebrated with a fun Math-themed general quiz - π-uiz

Mar 19, 2021 - Alumni Talk
Graph Verification with a Betweenness Oracle
Dr Mano Vikash Janardhanan, Applied Research Scientist in the Machine Learning Group, Lifion by ADP, New **York**

ASTRONOMY-PARSEC

In August 2020, there was an official revival of Parsec, the Astronomy and Space Science Club of IISER TVM to provide students pursuing these diverse fields of study a creative learning environment. Astronomy is an ever evolving field of study with fields of specialization as diverse as Astrophysics, Cosmology, Astrobiology, Astrochemistry, Astrophotography, and most recently Astronomical Data Analysis. Parsec organized several online events since its revival. The details are provided in the table.

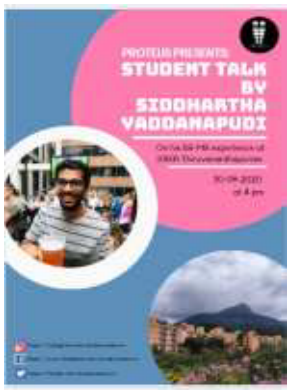
TALKS AND LECTURES	
1	Prof. Shankarnarayanan S (IIT-Bombay) Blind men and the elephant: Challenges in Cosmology
2	Dr. Devansh Agarwal (West Virginia University, IISER-TVM Alumni) Fantastic Bursts and How to find them
3	Prof. Anand Narayanan (IIST Thiruvananthapuram) The Large scale structure of the Universe
ASTROBIOLOGY LECTURE SERIES (In collaboration with ESI)	
1	Dr. Dimitra Atri (NYUAD, Abu Dhabi) Habitable planets in the Solar System and Beyond
2	Dr. Supratim Sengupta (IISER-Kolkata) A Physicist's perspective on the transition from Chemistry to Biology
3	Dr. Sanjay Som (BMSIS, NASA Ames Research Centre) Earth as an exoplanet
4	Dr. Julia Brodsky (BMSIS) Astrobiology and Us
5	Dr. Ivan Gláucio Paulino Lima (BMSIS, NASA Ames Research Centre) Extremophiles and Space Exploration
6	Dr. Sukrit Ranjan (Northwestern University) Theoretical Underpinnings of the Search for Life on Exoplanets
SOCIAL MEDIA AND EVENTS	
The Instagram and Facebook social media accounts of Parsec - have been used very effectively to connect with Astronomy clubs of other institutes, and also to create a network/ community of people with interest in Astronomy and Space.	

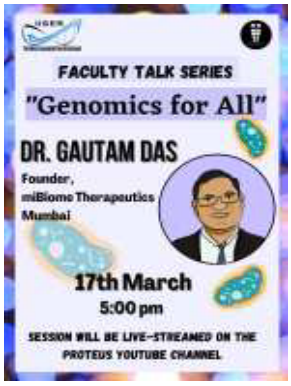
1	**Quiz – Astronomy Theme** Two quizzes were conducted over google meet, one open for all IISER TVM students, and the other exclusively for students of Batch 2020.
2	**Memecon – Astrobiology Theme** Conducted in collaboration with ESI. The cash prizes were sponsored by the School of Physics and the STC
3	**Art competition – Life in Space** Held in collaboration with ESI
4	**Debate competition – Astrobiology Theme** Conducted over google meet and judged by Dr. Harilal Madhavan.
5	**“A Message from Humanity”** An event themed on the Golden Record sent by the Voyager probes

PROTEUS: The Biology Club of IISER Thiruvananthapuram

Proteus is the official science club of the School of Biology at IISER TVM. Students and faculty use this space to hold discussions, debates, discourses and competitions on topics of special intertest, recent developments in biological sciences, general learning around biology and cross disciplinary biological research. In addition to organizing talks, symposia, competitions, Proteus has also encouraged the formation of a Student Journal Club with the primary objective of creating an active learning environment that trains students to critically analyze scientific literature, present the analysis, organize scientific articles and communicate research findings. Details of the activities of Proteus is presented in the table.

	SPEAKER	**AFFILIATION**
Invited Talks	Prof. S Murty Srinivasula	IISER TVM, India
	Prof. Maneesha Inamdar	Jawaharlal Nehru Centre for Advanced Scientific Research, India
	Dr. Mahmood Pouladi	National University of Singapore
	Dr. Stalin Raj	IISER TVM, India
	Dr. Kathrina Fernandez	Wild Otters Research Pvt. Ltd, India
	Dr. Andy Galpin	California State University, United States of America
	Dr. Swagatika Sahoo	IIT Madras, India
	Dr. Innes Anna Drinnenberg	Institute Curie, France
	Dr. Gautam Das	miBiome Therapeutics, India
	Siddhartha Y	Graduate student, Indiana University Bloomington
	Nadi Dixit	Graduate student, Universität Kassel, Germany
	Rafeeque Mavoor	Science Media Centre, IISER Pune
Rhetor 1.0 Mini-Symposium	Prof. Snehzana Oliferenko	Francis Crick Institute, United Kingdom
	Prof. Hajime Hirase	University of Copenhagen, Denmark
	Prof. Shubha Tole	Tata Institute of Fundamental Research, India
Student Journal Club	Irene Mariam Roy	IISER TVM, India
	Sreejith Alipra	IISER TVM, India
Model Organisms Talk Series	Dr. Ravi Maruthachalam	IISER TVM, India
Competitions	Stem Cell Week Debate, BioArt Competition, BLAST: A Treasure Hunt Color: A Photography Exhibit	


PROTEUS PRESENTS
STUDENT TALK
BY
SIDDHARTHA
VADDANAPUDI


FACULTY TALK SERIES
"Genomics for All"
DR. GAUTAM DAS
Founder,
miBiome Therapeutics
Mumbai
17th March
5:00 pm
SESSION WILL BE LIVE-STREAMED ON THE
PROTEUS YOUTUBE CHANNEL


PROTEUS PRESENTS
STUDENT TALK
Rafeeque Mavoor
Science Media Center, IISER Pune
9th March
5 pm

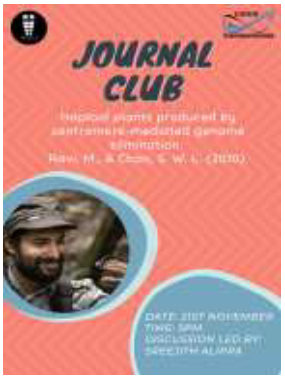

PROTEUS PRESENTS
RHETOR
Prof. Hajime Hirase
University of Copenhagen
Copenhagen, Denmark
15th Jan 2021
4 pm (IST)


PROTEUS PRESENTS
RHETOR
Dr. Snezhana Oliferenko
Francis Crick Institute,
London, UK
8th Jan 2021
5 pm (IST)


PROTEUS PRESENTS
STUDENT TALK
BY
MADI DIXIT

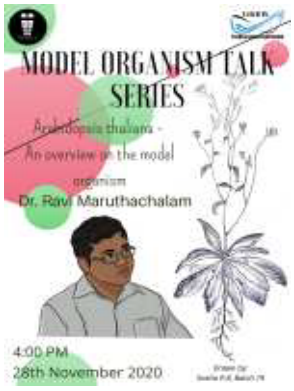

PROTEUS PRESENTS:
Stem Cell Awareness Week
FACULTY TALK SERIES
TWEAKING LONGEVITY
PATHWAYS IN STEM CELLS
8th October, Thursday
11:30am


PROTEUS PRESENTS
RHETOR
Prof. Shubha Tole
Tata Institute of
Fundamental Research
Mumbai, India
23rd Jan 2021
4 pm (IST)


JOURNAL
CLUB


PROTEUS PRESENTS:
Stem Cell Awareness Week
8th to 17th October
FACULTY TALK SERIES
VIVA LA VIVAD
PROTEUS JOURNAL CLUB
Stay tuned for more details


Faculty talk
By
Dr. Mahmoud Pouladi
NATIONAL UNIVERSITY
OF SINGAPORE
24th October
9:00 am


MODEL ORGANISM TALK
SERIES
An overview on the model
organism
Dr. Ravi Maruthachalam
4:00 PM
28th November 2020


JOURNAL
CLUB

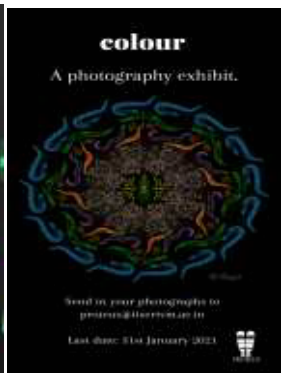

FACULTY
TALK SERIES
Friday,
19th February
7pm IST
Dr. Ines Anna Drinnenberg
INSTITUT CURIE,
PARIS, FRANCE.
Evolution of centromeres:
Conserved function, yet diverse
architectures


BLAST 1.0


Interactive Session with
Dr. Andrew Galpin
On Human Performance Science
& Sports Science
Thursday, 11th February 2021.
10:30 p.m. IST
Register for the talk!


BLAST 1.0
FINALE
13TH
MARCH


BLAST 1.0
PRELIMS


colour
A photography exhibit.


ORGANIZED BY PROTEUS,
CALL
FOR
BIO-ART!
A MODEL ORGANISM
DRAW-A-THON
OPEN FOR ALL STUDENTS

THE CHEMICAL SOCIETY OF IISER THIRUVANANTHAPURAM (CSIT)

The Chemical Society of IISER TVM (CSIT) is the Science club of the School of Chemistry. All faculty, students (excluding the first and second year BS-MS students), and alumni of the School of Chemistry are members of the CSIT. Such an intermingling of the chemistry fraternity allows for active participation, discussions, debates at multiple levels, in all specialized branches of chemistry.

The CSIT was officially inaugurated by Prof. J. N. Moorthy, Director and Prof. of Chemistry, IISER TVM, on January 08, 2021. The inaugural session was held in the PSB Seminar Hall, strictly following all the COVID protocols. Prof. Moorthy released the logo of the CSIT and delivered the first lecture of the Faculty Talk Series. The event concluded with a cultural show that was put together by the students of the School of Chemistry. All the other activities of the CSIT were held online.

The logo of the CSIT and what it signifies is explained below

The logo of the Chemical Society of IISER Thiruvananthapuram is a majestic emblem that renders an ethical feel of the World of Chemistry. The picturesque view of Agasthyamalai hills, rainforest, and water reservoir audaciously occupy the background of this logo. The symbol of people signifies the strength of Science in uniting students and researchers around the world. The logo highlights multidisciplinary aspects of Chemical Science suited for modern-day research and encourages thinking across boundaries. The importance of environmental preservation and clean energy are also delineated in the logo, and it sets a reminder for scientists to go hand in hand with nature.

Activities of the CSIT

The Faculty Talk Series included lectures by faculty from IISER TVM, and faculty from other research institutes. These talks focused on current research questions, findings of research and future research focus of the faculty. These talks made it possible for students of the Institute to interact with faculty from other leading institutions and learn first-hand the advances in niche areas of chemistry.

The Alumni Talk Series generated considerable interests among students as it gave them an opportunity to peep into what the future holds for them, the pit falls to avoid and potential career pathways to pursue, from experienced and authentic sources.

Special events are periodically hosted by CSIT to celebrate/ commemorate special days, events and achievements of the Chemistry community

The Social Media engagement of CSIT happens through Twitter, Instagram, Facebook, LinkedIn and YouTube, all of which were bustling with activity. These platforms were effectively used by the CSIT to stay connected and engaged with the Chemistry fraternity during the pandemic.

Summary of activities of the CSIT

Faculty Talk Series		
Date	**Speaker**	**Topic**
Jan 08, 2021	Prof. J. N. Moorthy Director and Prof. of Chemistry, IISER TVM	Molecules to Materials – Leveraging Sterics
Mar 26, 2021	Dr. Dibyendu Das Assistant Professor,. IISER Kolkata	How complexity emerges from chemistry?
Alumni/Student Talk Series		
Feb 08, 2021	Niyas M. A. (Batch 14) Julias- Maximilians University	Pursuing a Ph. D. Degree
Feb 08, 2021	Narmada Naidu (Batch 14) Rice University, USA	Pursuing a Ph. D.
Feb 24, 2021	Vinayak Bhat (Batch 13)	My journey from BS-MS to Ph. D. candidate: Expectations Vs Reality

Special Events	
Feb 11, 2021	Celebrating Women in Science On the occasion of "The International Day of Women and Girls in Science", CSIT organized a fascinating talk by Dr. Srabanti Chaudhury, (Associate Professor, IISER Pune). Dr. Srabanthi had the audience listening to her in rapt attention as she shared her life experiences as a woman scientist in one of the leading institutes for science research in the country.
Social Media	
The social media handles of the Chemical Society of IISER Thiruvananthapuram were abuzz with activity right through the pandemic. Students were able to get acquainted with various topics through the Instagram series that featured concepts like 'Named reactions', 'Analytical techniques in Chemistry', 'Branches of Chemistry etc. CSIT also successfully conducted a story challenge where students shared marvellous pictures and videos of reactions they performed in chemistry labs. BS-MS students also posted short Instagram reels of interesting chemical reactions performed by them.	

COUNSELING CENTER

MARCH 2020- APRIL 2021

The COVID-19 pandemic has had a major effect on our lives. Mental health continues to be an increasingly urgent issue that needs to be addressed and here at the IISER Trivandrum Counseling center, we offer mental health services to the students in order to reduce their psychological problems and distress and enhance their mental health, well being, and quality of life. The center consists of a psychologist (Dr. Neelima Gopinath) and a psychiatrist (Dr. Mary P R) who provide effective counseling services to students who come to them with a wide range of problems. This year due to lockdown and students not being in campus most of the sessions were conducted online. Even then overall the functioning of counseling center for the last one year was good as per the student turn over and response. Student satisfaction seems to be adequate as students were contacting us for help irrespective of them not being there in the campus. Majority of students had regular follow-ups.

In total, 131 students came for counseling in the specified period. There were 76 new students and 55 students who had already come before had to be seen again.Some of them had to be seen more number of times as per their requirement. This past year 343 counseling/psychotherapy sessions was conducted. The segregation of how many BSMS students and others (Ph. D., IPhd, Post Doc, and Project students) cannot be done due to the fact that the mode of appointments varied . Out of the total 76 new students, 9 have been referred to the psychiatrist for further evaluation and treatment. As per the statistics of students who consulted the psychiatrist there were in total 22 students and 147 sessions were conducted. Detailed case files are being maintained for every student who comes for counseling / psychiatric consultation with at most confidentiality. The predominant problems faced by students were stress related to academic issues as well as due to non-academic reasons, which includes relationship issues, adjustment problems and the unexpected turn of events due to the pandemic. Primary psychiatric illnesses are also detected in few of the students. Students are given supportive counseling, psychotherapy, stress management programs as well as medication in indicated cases.

In the beginning of the semester an orientation program were conducted for the new comers online in which the importance of counseling were briefed. Also a brochure for counseling center has been given to them so as to give them an overall idea about the functioning of the center and how they can make use of the facilities being provided to them. A counseling web page made with the idea to share information that promote mental health and bring awareness among students has been well received and more students are aware of our services and it has helped reduce stigma in seeking help.

ACTIVITIES RELATED TO COVID-19 PREVENTION IN IISER TVM CAMPUS'

Measures taken for controlling COVID-19 cases on campus:

A careful strategy of testing, tracing and quarantining was in place in the campus from the start of the COVID-19 pandemic. A COVID-19 Primary Response Team (CRT) was formed, with several associated teams for Primary Medical Care, Contact Tracing, Quarantine Facility Management, Sanitisation and Disinfection. Each team included faculty, staff and student members, all of who worked untiringly to effectively manage the COVID situation on campus.

Strict COVID-19 safety guidelines were implemented in the campus and all students, faculty and staff of the Institute diligently adhered to these set guidelines. Email reminders were also circulated from time to time, with updates on the COVID-19 cases on campus. Posters on COVID-19 awareness and various guidelines to be followed on campus were displayed at various locations in the campus. All academic, research, administrative and extracurricular activities on campus strictly adhered to the safety guidelines and protocols issued by the Institute administration.

Quarantine facility:
The D-block hostel with a capacity of 150 rooms was converted into a quarantine center for isolating COVID-19 positive persons, and all those identified as primary contacts by the contact tracing team. It was made mandatory for students returning to the campus, after a period of stay outside the campus, to undergo a one-week quarantine, in the quarantine block. Approximately, 1000 personnel have so far been quarantined in the D block facility.

COVID-19 Testing center:
In association with ICMR and the State Health Department, a state of the art COVID-19 Testing center, including a Biosafety Level-2+ lab, has been functional in IISER TVM campus since October 2020. The Centre tested about 300 samples every day, that included samples from within the Institute and samples from other localities of Nedumangad taluk in Thiruvananthapuram district.

Vaccination drive on campus:
All members of the IISER community with high risk of direct or indirect exposure to the virus received the first dose of the vaccine early on in 2021. With the COVID situation worsening in the state, the Institute administration implemented further measures to ensure that the campus remained insulated from the onslaught of the second wave of the corona virus. The CRT, Health Centre and the Institute management coordinated with the state health department and other government agencies/ government appointed private establishments, to conduct a vaccination drive in the campus, that was successfully implemented in mid-2021.

We have had only 5 confirmed positive cases of Corona in the campus, despite being a residential campus with about 1000 members. Certainly, this is an interesting testimony to the advantages of full concurrence to the COVID protocols recommended by health officials. Undoubtedly, these measures helped to keep the COVID-19 cases on campus in check, saved lives, and ensured that research and academic activities continued right through the pandemic.

Steps taken for continuing the academic activities during COVID-19:

Teaching for theory courses was completely online during Varsha 2020. Four state of the art studios were set up for recording high quality lectures. For the batches of students who returned to campus after the initial lockdown, in-person final exams and practical courses were conducted following COVID-19 protocols. For other batches, online proctored examinations were conducted on the Eklavya platform. Students with severe connectivity problems (like students from Lakshadweep) though not part of batches already on campus, were allowed to return to campus and write the exams in online mode.

Research and extension work related to COVID-19:

Groups at IISER TVM are in the process of establishing a state-of-the-art virus characterization platform to define relevant molecular targets of COVID-19, for the rapid development and evaluation of diagnostics and vaccines. A DST SERB grant was awarded on "Development and Evaluation of diagnostics and Candidate Vaccines for emerging SARS-Coronavirus-2 (DEC-VAC SARS). Several papers were published by research groups at IISER TVM on COVID-19 in reputed international journals.

Steps taken to create awareness on COVID-19 in terms of outreach among students and general public:

The Director of the Institute, Prof. J. N. Moorthy, along with the key functionaries of the Institute, held multiple online meetings with students to create awareness about the COVID 19 pandemic, and help them cope with the uncertainties and hardships imposed on them by the pandemic. Students received regular emails with guidelines and precautions to be followed to manage COVID-19. The Counselling Centre sent out regular updates and information on mental wellness to students. As a part of the COVID-19 Response activities on campus, awareness brochures and posters were printed and distributed throughout the campus. One of the editions of the newsletter of the Science and Technology Council (STC) 'Exhibit A' focused entirely on the pandemic. A special interview series "Into their minds" organized by STC interviewed several key scientists and policymakers in the country on the COVID pandemic. These interviews are available on the institute YouTube channel. Several online lectures/talks were given by faculty members on COVID-19 to other institutes/colleges and also on Doordarshan, the National television channel. Several outreach campaigns were also organized in the nearby tribal villages.

RIGHT TO INFORMATION (RTI)

The right to information has been recognized as a fundamental right and all Public Authorities are mandated to provide timely responses to any queries from citizens on the functioning of the Public Authority. The Right to Information Act 2005, not only empowers citizens but also lends transparency and assigns accountability in the functioning of Public Authorities.

The Government of India has an online portal, the RTI Request & Appeal Management System (RTI-MIS), through which an applicant can seek information on any Public Authority. IISER TVM is registered with the RTI-MIS. An applicant could obtain information about the Institute either through this online portal or by sending a request directly to the Public Information Officer (PIO), IISER Thiruvananthapuram, Maruthamala P.O, Vithura Grama Panchayath, Thiruvananthapuram – 695551.

IISER TVM, has received a total of 89 RTI queries in the financial year 2020-21 of which 81 queries were resolved in the first instance, 8 were resolved after the first appeal. About 27% of the RTI queries are addressed to the HR division, 19% to the Academic division, 17% to JAC division, 12% to DoFA, 7% to Finance, 6% to R&D, 5% to Project office, 3% to Academics/DoFA, 2% HR/ DoFA, 1% to Administration, while 1% was rejected. Figure 1 gives the division-wise percentage of queries received in the financial year 2020-21.

Maximum number of queries were received in the months of December 2020, followed by March 2021 and October 2020. Maximum appeals were received in the month of March 2021. The month-wise details of RTI queries received at IISER TVM in the financial year 2020-21 is summarized in Table 1, while Table 2 summarizes the details of appeals received in the financial year 2020-21.

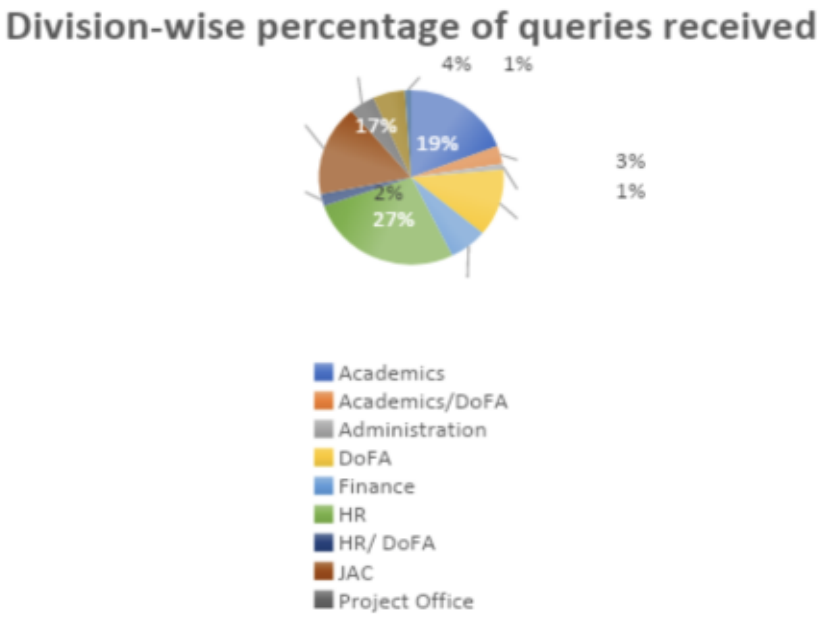
Table 1 – Month-wise details of RTI queries received in the financial year 2020-21

Division	Apr 2020	May 2020	Jun 2020	Jul 2020	Aug 2020	Sep 2020	Oct 2020	Nov 2020	Dec 2020	Jan 2021	Feb 2021	Mar 2021	Total
Academics	-	1	-	-	3	1	-	1	8	1	-	2	**17**
Academics/ DoFA	-	-	-	-	-	-	-	-	2	-	-	1	**3**
Administration	-	-	-	-	-	-	-	-	-	-	-	1	**1**
DoFA	-	1	1	2	-	1	1	-	1	3	-	1	**11**
Finance	-	-	-	-	-	2	1	-	1	1	-	1	**6**
HR	-	2	-	3	1	-	4	1	4	3	2	4	**24**
HR/ DoFA	-	-	-	-	-	-	-	-	-	-	1	1	**2**
JAC	-	-	-	-	-	-	4	4	4	-	2	1	**15**
Project Office	-	-	-	-	2	-	-	-	-	-	-	2	**4**
R&D	-	1	-	1	-	-	-	1	2	-	-	-	**5**
Rejected	-	-	-	-	-	-	-	-	1	-	-	-	**1**
TOTAL	-	5	1	6	6	4	10	7	23	8	5	14	89
Grand Total	89												

Table 2 – The month-wise details of RTI appeals received in the financial year 2020-21

Section	Apr 2020	May 2020	Jun 2020	Jul 2020	Aug 2020	Sep 2020	Oct 2020	Nov 2020	Dec 2020	Jan 2021	Feb 2021	Mar 2021	Total
Academics	-	-	-	-	-	-	-	-	-	1	-	1	2
DoFA	-	-	-	-	-	-	-	-	-	-	-	2	2
HR/ DoFA	-	-	-	-	-	-	-	-	-	-	-	1	1
JAC	-	-	-	-	-	-	-	1	1	-	1	-	3
TOTAL	-	-	-	-	-	-	-	1	1	1	1	4	8
Grand Total	8												

Figure 1 – Division-wise percentage of queries received in the financial year 2020-21



Suo moto disclosure

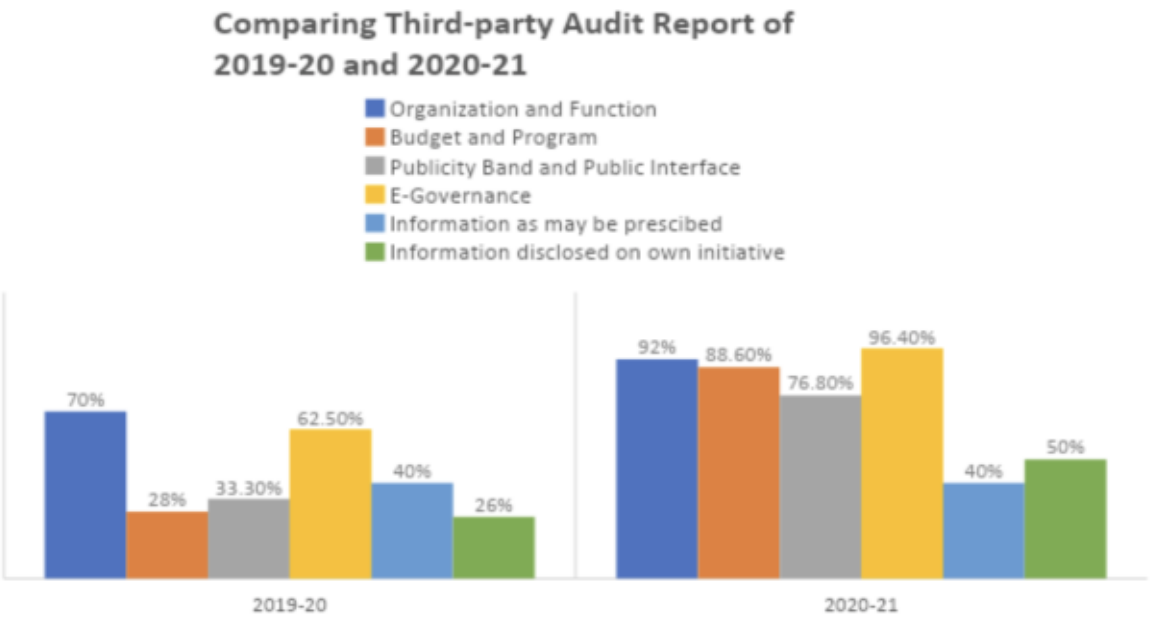
Suo moto disclosure by Public Authorities is a way of putting large volumes of information relating to the workings and functioning of the Public Authority in the public domain. Such voluntary disclosure helps reduce the need for obtaining information through individual RTI applications. The Suo moto declaration is classified into 6 major heads encompassing all aspects of the functioning of the Public Authority.

1) Organization and function
2) Budget and Program
3) Publicity Band Public Interface
4) E-Governance
5) Information as may be prescribed
6) Information disclosed on own initiative

Third-party Transparency audits of the suo moto disclosure is carried out annually, by specific Training Institutes identified by the CIC or the respective Ministry. The audit covers compliance checks as per guidelines issued by the CIC for self-disclosure, and examines if there are other information that may be proactively disclosed.

The Hyderabad chapter of the National Institute of Technical Teachers' Training and Research, Chennai, an autonomous educational institution under the Ministry of Human Resource Development, Government of India, conducted the Third-party audit of the suo moto disclosure of IISER TVM for 2020-21. Our self-disclosure score for 2020-21 is 78.5% as against 45.3% in the previous year. IISER TVM, as a Public Authority, is committed to making it's functioning transparent and accountable to its citizens, as evidenced from the 73.3% rate of increase in self-disclosure from 2019-20 to 2020-21. Figure 2 compares third-party audit report of 2019-20 and 2020-21.

Figure 2 – Comparing Third-party Audit report of 2019-20 and 2020-21



HUMAN RESOURCES

FACULTY STRENGTH

Faculty	**Regular and Contractual Faculty**	72 + 2
	Emeritus/Honorary/Visiting/ Adjunct Faculty	Emeritus Faculty - 2 Visiting Faculty - 8 Adjunct Faculty - 4

Faculty

Professor	School of Biology School of Chemistry School of Mathematics School of Physics	3 3 2 2
Associate Professor	School of Biology School of Chemistry School of Mathematics School of Physics	4 5 4 8
Assistant Professor Gr. I	School of Biology School of Chemistry School of Mathematics School of Physics	8 12 10 11
Assistant Professor Gr. II	School of Biology School of Chemistry School of Mathematics School of Physics	 1 1

School of Biology

Sl No	Name of the Faculty	Designation
1	Prof. Hema Somanathan	Professor
2	Prof. S Murthy Srinivasula	Professor
3	Prof. Tapas Manna	Professor
4	Dr. Kalika Prasada	Associate Professor
5	Dr. Nishant KT	Associate Professor
6	Dr. Ullasa Kodandaramaiah	Associate Professor
7	Dr. V Stanlin Raj	Associate Professor
8	Dr. Ramanathan Natesh	Assistant Professor
9	Dr. Ravi Maruthachalam	Assistant Professor
10	Dr. Jishy Varghese	Assistant Professor
11	Dr. Satish Khurana	Assistant Professor
12	Dr. N Sadananda Singh	Assistant Professor
13	Dr. Sabari Shankar Thirupathy	Assistant Professor
14	Dr. Nisha N Kannan	Assistant Professor
15	Dr. Poonam Thakur	Assistant Professor

School of Chemistry

Sl No	Name of the Faculty	Designation
1	Prof. K George Thomas	Professor
2	Prof. Kana M Sureshan	Professor
3	Prof. Mahesh Hariharan	Professor
4	Dr. Vinesh Vijayan	Associate Professor
5	Dr. R S Swathi	Associate Professor
6	Dr. Reji Varghese	Associate Professor
7	Dr. Sukhendu Mandal	Associate Professor
8	Dr. Ajay Venugopal	Associate Professor
9	Dr. A Thirumurugan	Assistant Professor
10	Dr. Alagiri Kaliyamoorthy	Assistant Professor
11	Dr. Ramesh Rasappan	Assistant Professor
12	Dr. Gokulnath Sabapati	Assistant Professor

Sl No	Name of the Faculty	Designation
13	Dr. V. Sivaranjana Reddy	Assistant Professor
14	Dr. Rajendra Goreti	Assistant Professor
15	Dr. Subrata Kundu	Assistant Professor
16	Dr. A Muthukrishnan	Assistant Professor
17	Dr. Basudev Sahoo	Assistant Professor
18	Dr. Soumen De	Assistant Professor
19	Dr. Veera Reddy Yatham	Assistant Professor
20	Dr. Narendra Kurra	Assistant Professor (Joined on 14-12-2020)

School of Mathematics

Sl No	Name of the Faculty	Designation
1	Prof. M.P. Rajan	Professor
2	Prof. Utpal Manna	Professor
3	Dr. P. Devraj	Associate Professor
4	Dr. Sachindranath Jayaraman	Associate Professor
5	Dr. Shrihari Sridharan	Associate Professor
6	Dr. Viji Z Thomas	Associate Professor
7	Dr. Dharmatti Sheetal	Assistant Professor
8	Dr. K R Arun	Assistant Professor
9	Dr. Saikat Chatterjee	Assistant Professor
10	Dr. Sarbeswar Pal	Assistant Professor
11	Dr. Srilakshmi K.	Assistant Professor
12	Dr. Geetha Thangavelu	Assistant Professor
13	Dr. Dond Asha Kisan	Assistant Professor
14	Dr. Dhanya Rajendran	Assistant Professor
15	Dr. Sudarshan Kumar K	Assistant Professor
16	Dr. Mithun Mukherjee	Assistant Professor (On lien)
17	Dr. Chamakuri Nagaiah	Assistant Professor (Joined on 03-11-2020)
18	Dr. Sumit Mohanty	Assistant Professor (Grade II) - Relieved on 30-09-2020

School of Physics

Sl No	Name of the Faculty	Designation
1	Prof. Anil Shaji	Professor
2	Prof. R. C. Nath	Professor
3	Dr. Joy Mitra	Associate Professor
4	Dr. M M Shaijumon	Associate Professor
5	Dr. Manoj AG Namboothiry	Associate Professor
6	Dr. Rajeev N. Kini	Associate Professor
7	Dr. Madhu Thalakulam	Associate Professor
8	Dr. Bindusar Sahoo	Associate Professor
9	Dr. Soumen Basak	Associate Professor
10	Dr. Somu Kumaragurubaran	Associate Professor
11	Dr. Sreedhar B Dutta	Assistant Professor
12	Dr. Deepshika Jaiswal Nagar	Assistant Professor
13	Dr. Amal Medhi	Assistant Professor
14	Dr. Ravi Pant	Assistant Professor
15	Dr. Bikas C. Das	Assistant Professor
16	Dr. M Suheshkumar Singh	Assistant Professor
17	Dr. D.V. Senthilkumar	Assistant Professor
18	Dr. Manik Banik	Assistant Professor
19	Dr. Tuhin Subhra Maity	Assistant Professor
20	Dr. Tanumoy Mandal	Assistant Professor
21	Dr. Vinayak B. Kamble	Assistant Professor
22	Dr. K. Shadak Alee	Assistant Professor (Grade II) - Relieved on 11-08-2020

Emeritus/honorary/Visiting/Adjunct Faculty

Sl No	Name of the Faculty	Subject
1	Prof. Y.D. Vankar Emeritus Professor	Chemistry
2	Prof. Suresh Das Emeritus Professor	Chemistry
3	Prof. N. Satyamurthy Visiting Professor	Chemistry
4	Prof. Ajayan Vinu Visiting Professor	Chemistry
5	Dr. T. V. Anil Kumar Adjunct Professor	Biology
6	Prof. M.R.N. Murthy Visiting Professor	Biology
7	Prof. N.K. Mathew Visiting Professor	Biology
8	Prof. Michael Gromiha Adjunct Professor	Biology
9	Prof. G.D.V. Gowda Visiting Professor	Mathematics
10	Dr. Shantanu Godbole Visiting Professor	Data Analysis
11	Prof. Thomas Kuruvila Adjunct Professor	Humanities
12	Prof. R.B. Sunoj Adjunct Professor	Machine Learning
13	Prof. Vinay Namboodiri Adjunct Professor	Data Science
14	Prof. Amit Mitra Adjunct Professor	Statistics

Administrative & Support Personnel

Sl No	Name of the Official	Designation
1	Shri. B V Ramesh	Deputy Registrar (Finance & Accounts)
2	Shri. Siva Dutt V K	Superintending Engineer
3	Dr. Sainul Abideen P	Assistant Librarian
4	Shri. Hariharakrishnan S	Deputy Registrar (Admn & Facility Management)
5	Shri. P Y Sreekumar	Scientific Officer (IT)
6	Shri. Priji E Moses	Assistant Executive Engineer (Civil)
7	Dr. Goldwin Hemalatha M	Medical Officer
8	Dr. Thiraviam P	Medical Officer
9	Shri. Sreehari S	Assistant Executive Engineer (Electrical)
10	Shri. Sudin B Babu	Deputy Registrar (Purchase, Stores & Faculty Affairs)
11	Shri. Manoj Kumar S	Assistant Registrar (Estb & HR)
12	Smt. Divya V J	Technical Officer
13	Smt. Nimi Joseph Chaly	Assistant Registrar (Research & Development)
14	Shri. Satya Srinivas Naraharisetti	Assistant Registrar (Academics)
15	Smt. Darli K G	Private Secretary
16	Smt. Navya Paul	Senior Technical Assistant
17	Shri. Vijesh K	Senior Technical Assistant
18	Shri. Krishna Kumar A	Senior Technical Assistant
19	Shri. Sangeeth M	Senior Technical Assistant
20	Shri. Alex Andrews P	Technical Assistant
21	Smt. Nafeesa C K	Library Information Assistant
22	Shri. Jayaraj J R	Library Information Assistant
23	Shri. Praveen Peter	Junior Engineer (Civil)
24	Shri. Arun Reghunath	Superintendent
25	Smt. Mini Philip	Personal Assistant
26	Shri. Adarsh B	Technical Assistant

Sl No	Name of the Official	Designation
27	Shri. Anilkumar P R	Technical Assistant
28	Shri. Naveen Sathyan	Technical Assistant
29	Shri. Ajith Prabha	Superintendent
30	Shri. Manoj M T	Accountant
31	Shri. Satheesh Raghavan	Superintendent
32	Smt. Veena P P	Personal Assistant
33	Smt. Suja V R	Office Assistant (Multi Skill)
34	Smt. Vidya Senan I	Office Assistant (Multi Skill)
35	Smt. Archana P R	Office Assistant (Multi Skill)
36	Smt. Beena N K	Office Assistant (Multi Skill)
37	Shri. Muruganandam A	Office Assistant (Multi Skill)
38	Shri. Rajesh A P	Office Assistant (Multi Skill)
39	Shri. Rakesh M V	Office Assistant (Multi Skill)
40	Shri. Jins Joseph	Nurse
41	Smt. Divya A T	Nurse
42	Shri. Arun Kumar M	Attendant –Electrical
43	Shri. Ratheesh C	Attendant –Plumber
44	Smt. Sarika Mohan	Junior Technical Assistant
45	Shri. Vivek V G	Junior Technical Assistant
46	Shri. Pradeep Kumar G T	Junior Technical Assistant
47	Shri. Nibith Kumar K P	Junior Technical Assistant
48	Ms. Lakshmi C	Junior Technical Assistant
49	Shri. Packiya Rajan	Junior Technical Assistant
50	Shri. Muthukumaran A	Junior Technical Assistant
51	Smt. Sruthi U.A	Junior Hindi Translator
52	Shri. Arun Raj J R	Physical Education Instructor
53	Shri. Ashinraj D	Junior Engineer (Civil)
54	Shri. Sarath Kumar R	Junior Engineer (Electrical)
55	Smt. Sandhya P S	Technical Assistant
56	Shri. Aneesh A	Technical Assistant

Sl No	Name of the Official	Designation
57	Smt. Nithya Rani	Technical Assistant
58	Smt. Lekshmi Thampi	Technical Assistant
59	Smt. Deepthi P	Technical Assistant
60	Smt. Lekshmi Devi L	Technical Assistant
61	Ms. Amritha Sivan	Junior Technical Assistant
62	Smt. Lincy Varghese	Junior Technical Assistant
63	Ms. Aathira S	Junior Technical Assistant
64	Shri. Subin S	Junior Technical Assistant
65	Smt. Sruthi R Balu	Office Assistant (Multi Skill)
66	Shri. Anil Prakash M	Office Assistant (Multi Skill)
67	Shri. Pradeep Kumar C	Office Assistant (Multi Skill)
68	Shri. Santhosh B S	Office Assistant (Multi Skill)
69	Shri. Nagarjuna Paidisetty	Office Assistant (Multi Skill)
70	Shri. Anas A Z	Office Assistant (Multi Skill)

Consultants and Contractual Officers

Sl No	Name of the Official	Designation
1	Shri. Gopakumaran Nair	Assistant Security Officer
2	Shri. Jayan V	Assistant Security Officer

R AND D INFORMATION 2020-21

NEW EXTRAMURAL GRANTS (2020-21)

Sr.No.	Name of the Project	Project Leader	Project Code	Funding Agency	Period From	Period To	Funds Received During the Year (Amount in Lakhs)
1	Quasi-optimality of adaptive finite element methods for elliptic optimal control problems	DR. ASHA KISAN DOND	SRG/2020/001027	SERB	23.12.2020	22.12.2022	7.94
2	Inspire Faculty Fellowship	DR. FAZALURAHMAN KUTTASSERY	DST-INSPIRE FACULTY FELLOWSHIP/BATCH-16/2020-DST/INSPIRE/04/2019/002362	DST	04.01.2021	03.01.2026	22.00
3	Ramanujan Fellowship	DR. JOYDEB MANDAL	RJF/2020/000103	SERB	08.03.2021	07.03.2026	Fund Received in 2021-22
4	Realizing distributed quantum computing with silicon-based spin qubits	DR. MADHU THALAKULAM	DST-DST/ICPS/QuST/Theme-4/2019/General	DST	24.02.2020	23.02.2023	900.82
5	Inspire Faculty Fellowship	DR. MATHEW ARUN THOMAS	DST-INSPIRE FACULTY FELLOWSHIP/BATCH-16/2020-DST/INSPIRE/04/2019/002507	DST	20.10.2020	19.10.2025	22.00
6	HPC technologies and large-scale simulation of the electromechanics for the heart function	DR. NAGAIAH CHAMAKURI	DST/NSM/R&D_HPC_Applications/2021/03.28	DST	23.03.2021	22.03.2023	Fund Received in 2021-22
7	Stereoselective Total Synthesis of Atisan Based Diterpenoids Antiquorpenes	DR. RAJENDAR GORETI	CRG/2020/003737	SERB	18.12.2020	17.12.2023	22.57
8	Structure, function and molecular mechanism of transcription regulators in Mycobacterium spp.	DR. RAMANATHAN NATESH	MHRD-STARS/APR2019/BS/729/FS	MHRD	15.05.2020	04.05.2023	19.48
9	Olfactory cues used in stingless bee foraging-recruitment behavior:behavioral and neuronal perspectives	DR. RESHMA BASAK	PDF/2020/000943	SERB	04.02.2021	03.02.2023	10.13
10	Development of next generation all-solid-state sodium-sulfur batteries for lighting and consumer electronic applications	DR. SHRUTI SURIYAKUMAR	PDF/2020/000209	SERB	12.01.2021	11.01.2023	10.13
11	Inspire Faculty Fellowship	DR. SOORAJ K	DST-INSPIRE FACULTY FELLOWSHIP/BATCH-16/2020-DST/INSPIRE/04/2019/001843	DST	13.10.2020	12.10.2025	22.00
12	Design of chiral self-sorting and stimuli-responsive dynamic chiral cages and host-guest chemistry	DR. SOUMEN DE	SRG/2020/001486	SERB	23.12.2020	22.12.2022	16.51
13	Utilization of Oleophilic Atomically Precise Metal Nanocluster in Aqueous Medium Through Host-Guest Self-Assembly Approach	DR. SOURAV BISWAS	PDF/2020/001085	SERB	22.12.2020	21.12.2025	10.13
14	Development and Evaluation of diagnostics and Candidate VACacines for emerging SARS-Coronavirus-2 (Dec-VAC-SARS)	DR. STALIN RAJ VICTOR	IPA/2020/000070	SERB	23.12.2020	22.12.2023	58.71
15	ENDFLU - Evaluation of Rationally Designed Influenza Vaccines	DR. STALIN RAJ VICTOR	BT/IN/EU-INF/15/RV/19-20	DBT	31.12.2020	30.12.2025	35.02
16	Modelling, Analysis and Prediction for SARS-CoV-2 Infections	DR. UTPAL MANNA	MSC/2020/000029	SERB	30.06.2020	29.06.2021	4.30
17	Schurs Exponent Conjecture	DR. VIJI Z THOMAS	MTR/2020/000483	SERB	10.02.2021	09.02.2024	2.20
18	Open quantum systems - Non Markovian dynamics and Not completely Positive Maps	PROF. ANIL SHAJI	DST-DST/ICPS/QuST/Theme-4/2019/General	DST	24.02.2020	23.02.2023	122.28
19	Organisation of Summer Schools	PROF. ANIL SHAJI	DST-DST/ICPS/QuST/Theme-4/2019/General	DST	24.02.2020	23.02.2023	20.00
20	Development of porous titania supported Lithium Hydroxide for efficient capture of carbon-di-oxide	PROF. K M SURESHAN	ISRO/RES/3/861/20-21	ISRO	16.11.2020	15.11.2022	3.89
21	Understanding the regulation of kinetochore protein phosphorylation for the activation of spindle assembly check-point	PROF. TAPAS KUMAR MANNA	CRG/2020/002452	SERB	11.03.2021	10.03.2024	22.49

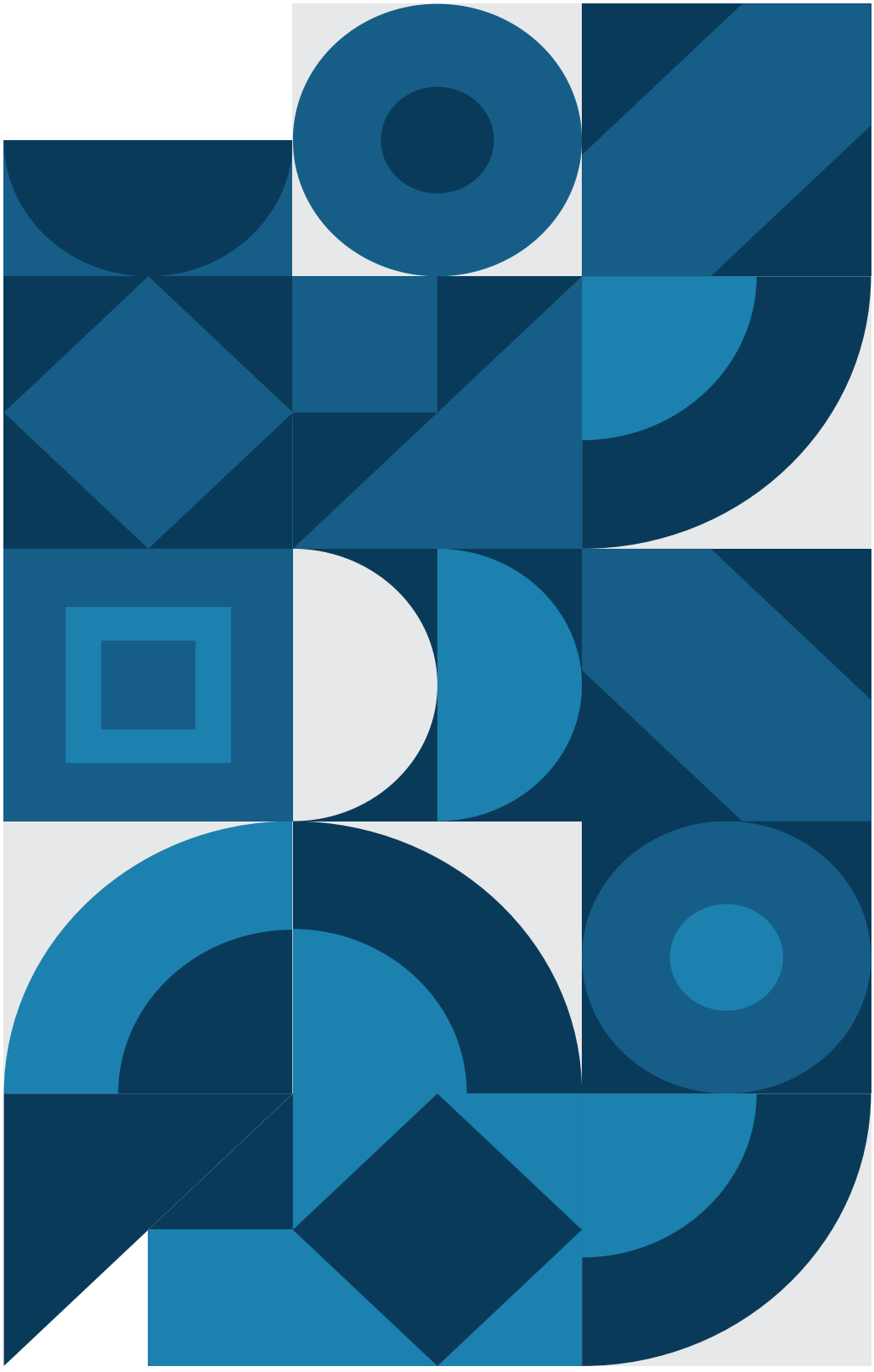
ONGOING EXTRAMURAL GRANTS (2020-21)

Sr.No.	Name of the Project	Project Leader	Project Code	Funding Agency	Period From	Period To	Funds Received During the Year (Amount in Lakhs)	Remarks
1	Exploring the active sites of nitrogen and boron containing/doped materials:N2-C-B type active sites for eclectrocatalytic 4-electron oxygen reduction reaction	DR. A MUTHUKRISHNAN	DST/TMD/HFC/2K18/24[C] & [G]	DST	17.09.2019	16.09.2022	-	
2	Al(I)/Al(III) Lewis Pairs for the Activation of Inert Chemical Bonds	DR. AJAY VENUGOPAL	CRG/2019/005040	SERB	01.01.2020	31.12.2022	5.00	
3	Electrophilic Aluminium Compounds for Catalytic CO2 Hydrosilylation	DR. AJAY VENUGOPAL	MHRD-STARS/APR2019/CS/250/FS	MHRD	31.12.2019	30.12.2022	-	
4	Directed Site-Selective C-H Functionaization of Aromatic and Heteroaromatic Precursors	DR. ALAGIRI KALIYAMOORTHY	EEQ/2016/000231	SERB	11.05.2017	10.05.2021	6.30	
5	Brain-like computing-Designing the basic building blocks for artificial neurons and synapses	DR. BIKAS C DAS	184-15/2018 (IC)	UGC	01.04.2018	31.03.2021	-	
6	Conformal approach to supergravity: New Perspectives and Applications	DR. BINDUSAR SAHOO	CRG/2018/002373	SERB	27.03.2019	26.03.2022	2.50	
7	Development of solid state hybrid hydrogen using Palladium and Magnesium nanoclusters	DR. DEEPSHIKHA JAISWAL NAGAR	ISRO-DS-2B-13012 (2)/42/2017	ISRO	01.03.2018	08.12.2021	2.23	
8	Palladium and Magnesium based hybrid nanocluster structures for high gravimetric capacity hydrogen storage	DR. DEEPSHIKHA JAISWAL NAGAR	DST/TMD/HFC/2K18/37 (C) & (G)	DST	17.09.2019	16.09.2022	-	
9	Study of Convolution Operators on Topological Groups	DR. DEVARAJ PONNAIAN	MTR/2018/000559	SERB	14.03.2019	13.03.2022	2.20	
10	Inspire Faculty Award	DR. DHANYA RAJENDRAN	DST-INSPIRE FACULTY AWARD - IFA-15-MA-72	DST	20.04.2016	19.04.2022	11.67	PROJECT TRANSFERRED FROM IIT GOA
11	On certain class of diagram algebras arising from Schur-Weyl duality	DR. GEETHA T	MTR/2017/000424	SERB	06.06.2018	05.06.2021	1.00	
12	Design and Synthesis of Pie Extended and Ring- Extended Bis- Macrocycle and Investigating their Photophysical Properties for Optoelectronic Applications	DR. GOKULNATH SABAPATHI	CRG/2019/006303	SERB	05.02.2020	04.02.2023	-	
13	Infrared Plasmonics of Nanostructured Conducting Oxides for communication and spectroscopic applications	DR. JOY MITRA	CRG/2019/004965	SERB	07.02.2020	06.02.2023	-	
14	One-Dimensional Parity-Time (PT) Symmetric Optical Structures With Layered Media	DR. K SHADAK ALEE	CSIR-03 (1457)/19/EMR-II	CSIR	05.08.2019	04.08.2022	-	RELIEVED FROM INSTITUTE
15	Functional Characterization of Genetic And Epigenetic Regulatory Networks Involved in the Reproductive Development in Rice	DR. KALIKA PRASAD	BT/PR12394/AGIII/103/891/2014	DBT	20.11.2015	19.11.2021	-	
16	Control of stem cell heterogeneity during shoot regeneration in Arabidopsis - a functional and mechanistic analysis of is epigenetic regulators	DR. KALIKA PRASAD	EMR/2017/002503	SERB	21.05.2019	20.05.2022	10.00	
17	Noble-Metal free Advanced Catalysts for Hydrogen Generation and Fuel Cell Applications	DR. M M SHAIJUMON	DST/TMD/MES/2K18/136 (C) & (G)	DST	23.10.2019	22.10.2022	-	
18	Hybrid Energy Storage Devices based on Multifunctional Nanocomposite Materials	DR. M M SHAIJUMON	DST/TMD/MES/2K16/114 (C) & (G)	DST	23.05.2017	22.11.2020	-	
19	Engineered 2-dimensional transition metal Dichalcogenide (TMD) nanostructures for efficient hydrogen generation	DR. M M SHAIJUMON	EMR/2017/000484	SERB	12.09.2017	11.09.2020	-	
20	Light Induced Energy Technologies: Utilizing Promising 2D Nanomaterials (Lite Up 2D)	DR. M M SHAIJUMON	IUSSTF/JC-071/2017	OTHERS	09.03.2018	30.09.2020	-	
21	Multi-wavelenth Selective Plane Illumination Microscope - with simultaneous magnification at mutiple levels: A promising imaging technology for molecular and cellular biology	DR. M SUHESH KUMAR SINGH	BT/PR30005/MED/32/657/2018	DBT	13.09.2019	12.09.2022	9.00	
22	Van Der Waals superconducting circuits operating at elevated temperatures & magnetic fields	DR. MADHU THALAKULAM	CRG/2018/004213	SERB	20.03.2019	19.03.2022	-	
23	Quantum point contract charge amplifiers embedded in a planar superconducting microwave resonator: Quantum-limited charge sensing and counting	DR. MADHU THALAKULAM	MHRD-STARS/APR2019/PS/363/FS	MHRD	31.12.2019	30.12.2022	-	
24	Inspire Faculty Award	DR. MANIK BANIK	DST-INSPIRE FACULTY AWARD/BATCH-13/2017	DST	18.04.2018	17.04.2023	9.69	PROJECT TRANSFERRED FROM S. N. Bose National Centre for Basic Sciences, KOLKATA

25	Integration of 2D materials in organic and organic-inorganic hybrid solar cells:Insights into charge extraction and transport	DR. MANOJ A G NAMBOOTHIRY	MHRD-STARS/APR2019/PS/308/FS	MHRD	31.12.2019	30.12.2022	-	
26	Approaches to improve open circuit voltage and fill factor-Enhancing the power conversion efficiency in organic and organic-inorganic hybrid systems	DR. MANOJ A G NAMBOOTHIRY	DST/TMD/SERI/S15 (C) & (G)	DST	17.05.2017	16.05.2020	5.11	
27	Application-development of genome editing tools for gene target discovery and understanding regulation of cholesterol metabolism genes	DR. N SADANANDA SINGH	BT/RLF/Re-entry17/2015	DBT	01.08.2017	31.07.2022	4.99	
28	CRISPR/CAS9 based whole genome screening for response to drug treatment	DR. N SADANANDA SINGH	ECR/2016/000979	SERB	17.07.2018	16.07.2021	8.00	
29	Development of New and Utilization of Existing Crispr-Cas Tools to Understand Genetic Regulators of Cytoskeleton in Cardiomyocyte	DR. N SADANANDA SINGH	EEQ/2018/001090	SERB	22.03.2019	21.03.2022	9.00	
30	Mathematical analysis for an optimal control of reaction-diffusion equations in cardiac defibrillation	DR. NAGAIAH CHAMAKURI	EMR/2017/000664	SERB	01.11.2018	31.10.2021	2.89	PROJECT TRANSFERRED FROM MAHINDRA ECOLE CENTRALE, HYDERABAD
31	Numerical analysis and simulation of state constrained optimization for multiscale problems	DR. NAGAIAH CHAMAKURI	MTR/2017/000598	SERB	01.06.2018	31.05.2021	1.75	PROJECT TRANSFERRED FROM MAHINDRA ECOLE CENTRALE, HYDERABAD
32	Elucidating post-transcriptional regulation of circadian behavior in Drosphila	DR. NISHA N KANNAN	IA/I/15/2/502329	DBT	01.01.2017	31.12.2021	11.62	
33	Mechanism of meiotic crossing over through the Msh4-Msh5 dependent pthway	DR. NISHANT K T	CRG/2018/000916	SERB	22.03.2019	21.03.2022	-	
34	Scheme for Promotion of Academic and Research Collaboration (SPARC)	DR. NISHANT K T	SPARC/2018-2019/58/SL (IN)	MHRD	15.03.2019	31.03.2022	-	
35	Metal decorated graphynes for molecular absorption	DR. R S SWATHI	1640/2017/KSCSTE	KSCSTE	01.10.2018	30.09.2021	-	
36	Investigation of the interaction of acoustic phonons with electrons in semiconductor nanostructures	DR. RAJEEV N KINI	KSCSTE/431/2018-KSYSA-RG	KSCSTE	01.06.2018	31.05.2021	8.37	
37	Terahertz spectroscopic studies of layered 2-D materials	DR. RAJEEV N KINI	CRG/2019/004865	SERB	18.01.2020	17.01.2023	-	
38	Twistronics with transition metal dichalcogenides	DR. RAJEEV N KINI	IPA/2020/000021	SERB	26.03.2020	26.03.2025	-	
39	Ramanujan Fellowship	DR. RAJENDAR GORETI	SB/S2/RJN-071/2015	DST	31.10.2016	30.10.2021	4.20	
40	Targeted Editing Of Potato Genome To Develop Variety Specific True Potato Seed (TPS)	DR. RAVI MARUTHACHALAM	ICAR-NASF/GT-7024/2018-19	ICAR	01.11.2018	31.10.2021	9.84	
41	Epigenetic modulation of centromeres to produce in vivo haploids by triggering uniparental genome elimination in plants	DR. RAVI MARUTHACHALAM	MHRD-STARS/APR2019/BS/818/FS	MHRD	31.12.2019	30.12.2022	-	
42	Microresonator frequency combs in visible: A path to ultrashort pulse generation and spectroscopy	DR. RAVI PANT	CRG/2019/000993	SERB	15.01.2020	14.01.2023	-	
43	Ramanujan Fellowship	DR. RAVI PANT	SB/S2/RJN-069/2014	DST	17.12.2015	16.12.2020	-	
44	High fluorine content DNA micelle: A Universal "OFF/ON" 19F-NMR-based probe for the detection of miRNA and Telomerase for cancer diagnosis	DR. REJI VARGHESE	BT/PR30172/NNT/28/1593/2018	DBT	11.02.2019	10.02.2022	13.22	
45	Conflict between Replication and Transcription accelerates Mutagenesis and drives Antibiotic Resistance	DR. SABARI SANKAR THIRUPATHI	IA/I/18/2/504037	DBT	01.10.2019	30.09.2024	37.03	
46	Guage theory of categorical principal bundles	DR. SAIKAT CHATTERJEE	MTR/2018/000528	SERB	12.03.2019	11.03.2022	2.20	
47	Moduli Space of Vector Bundles Over Smooth Projective Surfaces and ACM Bundles	DR. SARBESWAR PAL	EMR/2015/002172	SERB	15.05.2018	14.05.2021	0.80	
48	Understanding the role of Periostin-Itgav interactions in adult and fetal hematopoiesis	DR. SATISH KHURANA	IA/I/15/2/502061	DBT	01.12.2016	30.11.2021	33.78	
49	Investigating post-transcriptional regulation of steroidogenic genes during development	DR. SMITHA VISHNU	SR/WOS-A/LS-457/2017 (G)	DST	19.02.2019	18.02.2022	10.45	
50	Combinatorial exploration and property control of oxide based power semiconductors	DR. SOMU KUMARAGURUBARAN	DST/INT/JSPS/P-288/2019	DST	26.06.2019	25.06.2021	-	

51	Insights into the Interplay of H2S and NO at Redox Active Metal sites	DR. SUBRATA KUNDU	ECR/2017/003200	SERB	20.07.2018	19.07.2021	4.00	
52	Numerical analysis and computational methods for hyperbolic conservation laws	DR. SUDASHAN KUMAR	MTR/2017/000649	SERB	13.06.2018	12.06.2021	1.59	PROJECT TRANSFERRED FROM IIT GUWAHATI
53	Tailoring the Catalytic Properties of Atom-Precise Metal Nanoclusters	DR. SUKHENDU MANDAL	EMR/2016/007501	SERB	09.07.2018	08.07.2021	9.00	
54	Atomically precise alloy nanocluster as promising electro-catalyst for carbon dioxide and nitrogen reduction	DR. SUKHENDU MANDAL	DST/INT/JSPS/P-285/2019	DST	26.06.2019	25.06.2021	0.79	
55	Some Extremum Eigenvalue Problems Related To Combinatorial PDE	DR. SUMIT MOHANTY	MTR/2017/000458	SERB	29.05.2018	28.05.2021	-	RELIEVED FROM INSTITUTE
56	Women Scientist Scheme - Novel polymer supported chiral metal catalysts: asymmetric cross-coupling reactions	DR. TAMILSELVI CHINNUSAMY	SR/WOS-A/CS-105/2016 (C) & (G)	DST	18.08.2017	17.08.2020	-	
57	Understanding diversification of Impatiens species in the Northern Western Ghats	DR. ULLASA KODANDARAMIAH	BT/PR27535/NDB/39/600/2018	DBT	24.09.2018	23.09.2021	-	
58	Comparative biogeography of plants of the Western Ghats	DR. ULLASA KODANDARAMIAH	BT/PR12720/COE/34/21/2015	DBT	14.05.2015	13.05.2020	-	
59	Inspire Faculty Award - Development of Novel metal oxide-graphene based nanocomposite Materials for Microsensors and Nano electronics device applications	DR. VINAYAK B KAMBLE	DST/INSPIRE Faculty Award/2016/DST/INSPIRE/04/2015/002111	DST	28.07.2016	27.07.2021	14.86	
60	Junction Barrier modulation study in engineered core-shell oxide heterostructure Gas sensor device	DR. VINAYAK B KAMBLE	DST/NM/NT/2018/124 (C) & (G)	DST	30.10.2018	29.10.2021	9.50	
61	Study of Novel Oxide and Graphene Core Shell nanoarchitectures for High Temperature Thermoelectric Power Generations	DR. VINAYAK B KAMBLE	EEQ/2018/000769	SERB	16.03.2019	15.03.2022	3.00	
62	Structural and thermodynamic study of the phase separation of TIA1 in the presence of Tau protien and the influence of the phase separation on protien aggregation	DR. VINESH VIJAYAN	CRG/2019/004880	SERB	05.02.2020	04.02.2023	7.00	
63	Structural characterization of functional prion domain of mammalian cytoplasmic polyadenylation element-binding protein 3 (CPEB3)	DR. VINESH VIJAYAN	MHRD-STARS/APR2019/BS/708/FS	MHRD	31.12.2019	30.12.2022	-	
64	FIST PROGRAM	HOD, SOB	SR/FST/LS-II/2018/217 [C]	DST	27.08.2019	26.08.2024	-	
65	FIST Program	HOD, SOC	SR/FST/CSII-042/2016 [C]	DST	07.03.2017	06.03.2022	-	
66	FIST PROGRAM	HOD, SOP	SR/FST/CSII-042/2016 [C]	DST	22.07.2019	21.07.2024	-	
67	Localization and flow of information in quantum computing and open quantum dynamics	PROF. ANIL SHAJI	EMR/2016/007221	SERB	13.07.2017	01.04.2021	-	
68	Integrating collective behaviour with biomechanics of social spider webs	PROF. HEMA SOMANATHAN	CRG/2019/003805	SERB	19.03.2020	18.03.2023	-	
69	Community Plant-Pollinator Interactions at the Landscape Level	PROF. HEMA SOMANATHAN	BT/PR12720/COE/34/21/2015	DBT	14.05.2015	13.05.2020	-	
70	Ecology and Conservation of Freshwater Swamp Ecosystems of the Western Ghats-Kerala Region	PROF. HEMA SOMANATHAN	BT/PR12720/COE/34/21/2015	DBT	14.05.2015	13.05.2020	-	
71	The Effect of Interannual Variation in Flowering Intensity, Periodicity and Synchrony on Pollution and Fruit Set in a Highly Seasonal Tropical Forest in the Western Ghats	PROF. HEMA SOMANATHAN	EMR/2014/000705	SERB	13.03.2018	12.03.2021	-	
72	Design of a Surface-Enhanced Spectroscopy Based Device for the Rapid Detection of Organophosphate Pesticides and Pyrethroid Insecticides in Fruits and Vegetables	PROF. K GEORGE THOMAS	SR/S9/Z-05/2015	SERB	19.08.2017	31.03.2022	3.71	
73	JC BOSE FELLOWSHIP	PROF. K GEORGE THOMAS	SB/S2/JCB-64/2013	SERB	01.06.2019	31.05.2024	14.00	
74	Synthesis of Pseudoprotiens by Topochemical Azide-Alkyne Cycloaddition Reactions	PROF. K M SURESHAN	CRG/2018/000577	SERB	30.03.2019	29.03.2022	13.00	
75	Unravelling the interplay of reorganization energy, driving force and electronic coupling on the rate of electron transfer	PROF. MAHESH HARIHARAN	CRG/2019/002119	SERB	06.02.2020	05.02.2023	2.00	

76	Charge and Energy Transfer in Molecular Multifunctional Materials	PROF. MAHESH HARIHARAN	INT/ITALY/P-9/2016(ER)	DST	16.11.2017	15.11.2020	-	
77	Study of Exotic Ground States in Frustrated Triangular Lattice Antiferromagnets	PROF. RAMESH CHANDRA NATH	CRG/2019/000960	SERB	20.12.2019	19.12.2022	2.00	
78	Synthesis and Characterization of Frustrated Spin-1/2 Chain Compounds	PROF. RAMESH CHANDRA NATH	37(3)/14/26/2017	DAE	29.12.2017	31.03.2021	8.48	
79	Identification and Characterization of Molecular Pathways involved in Immune –related Autophagy	PROF. SRINIVASA MURTY SRINIVASULA	BT/PR21325/BRB/10/1554/2016	DBT	15.03.2018	14.03.2022	21.90	
80	RNF 167, an ubiquitin E3 ligase with several reported mutations in diverse cancers, controls NF-kB activation	PROF. SRINIVASA MURTY SRINIVASULA	EMR/2016/008048	SERB	22.06.2018	21.06.2021	6.00	
81	Eludicating the Role of GTP-Induced Transition of EB1 Dimer to Monomer in the Regulation of Microtubule Plus Ends	PROF. TAPAS KUMAR MANNA	CSIR-37(1688)/17/EMR-II	CSIR	01.05.2017	30.04.2020	-	
82	Identification and characterization of the molecular factors for the quality-control of kinetochore size and fidelty of spindle-chromosome attachment	PROF. TAPAS KUMAR MANNA	BT/PR30271/BRB/10/1740/2018	DBT	29.07.2019	28.07.2022	18.61	
83	The role of colonic hepatic Tumor Over-expressed Gene (chTOG) in regulation of kinetochore size and fidelity of mitotic chromosome segregation	PROF. TAPAS KUMAR MANNA	BT/HRD-NBA-NWB/38/2019-20(7)	DBT	19.02.2020	18.02.2023	-	
84	To Determine the Role of Ubiquitin Ligase Scf-Fbxw7 in Regulation of Centriole Biogenesis and Duplication in Human Cells	PROF. TAPAS KUMAR MANNA	EMR/2016/001562	SERB	29.03.2017	28.08.2020	-	
85	Study of Stochastic Nematic Liquid Crystal Models and Related Constrained Physical Problems	PROF. UTPAL MANNA	MTR/2018/000034	SERB	14.03.2019	13.03.2022	1.00	



Accounts

INDIAN INSTITUTE OF SCIENCE EDUCATION AND RESEARCH
THIRUVANANTHAPURAM
BALANCE SHEET AS AT 31st MARCH 2021

Amount-Rs.

SOURCES OF FUNDS	Schedule No	2020-21	2019-20
UNRESTRICTED FUND			
CORPUS/ CAPITAL FUND	1	7,36,42,65,317	7,40,42,57,321
DESIGNATED/ EARMARKED FUNDS	2		
CURRENT LIABILITIES AND PROVISIONS	3	62,70,46,961	57,06,25,342
UNSPENT BALANCE OF EXTERNAL PROJECTS	3A	25,50,99,594	20,83,23,455
SPONSORED FELLOWSHIPS & SCHOLARSHIPS	3B	1,61,48,389	1,51,53,502
UNSPENT BALANCE OF GRANT - MHRD	3C	1,49,28,01,786	1,58,90,28,180
TOTAL		**9,75,53,62,047**	**9,78,73,87,800**
APPLICATION OF FUNDS			
FIXED ASSETS	4		
TANGIBLE ASSETS		3,82,47,69,155	3,98,97,24,211
INTANGIBLE ASSETS		2,66,93,243	3,75,19,526
CAPITAL WORK-IN-PROGRESS		2,64,19,33,435	2,61,18,13,191
INVESTMENTS FROM EARMARKED / ENDOWENT FU	5		
LONG TERM INVESTMENT			
SHORT TERM INVESTMENT			
INVESTMENT - OTHERS	6		
CURRENT ASSETS	7	97,40,71,079	98,27,92,988
LOANS, ADVANCES & DEPOSITS	8	2,28,78,95,135	2,16,55,37,884
TOTAL		**9,75,53,62,047**	**9,78,73,87,800**
SIGNIFICANT ACCOUNTING POLICIES	23		
CONTINGENT LIABILITIES AND NOTES TO ACCOUNTS	24		

(B.V. Ramesh)
Deputy Registrar (F&A)

(Col.Robinson George)
Registrar

(Prof.Srinivasa Murty Srinivasula)
Professor-in-Charge (Administration)

(Prof. Jarugu Narasimha Moorthy)
Director

INDIAN INSTITUTE OF SCIENCE EDUCATION AND RESEARCH THIRUVANANTHAPURAM
INCOME AND EXPENDITURE ACCOUNT FOR THE PERIOD/YEAR ENDED 31st MARCH 2021

PARTICULARS	Schedule	2020-21	2019-20
INCOME			
Academic Receipts	9	57,986,463	46,802,380
Grants & Subsidies	10	593,002,805	568,847,409
Income from Investments	11		
Interest Earned	12		
Other Income	13	52,754,590	64,923,008
Prior Period Income	14		
TOTAL (A)		**703,743,858**	**680,572,797**
EXPENDITURE			
Staff Payments & Benefits	15	254,350,753	288,840,751
Employees Retirement and Terminal Benefits	15 A	5,138,939	
Acadamic Expenses	16	98,636,696	102,121,679
Administrative & General Expenses	17	154,550,182	114,082,398
Transportation Expenses	18	6,078,693	11,038,962
Repairs & Maintanence	19	78,798,591	51,657,455
Finance cost	20	587,890	1,106,164
Other Expenses	21		
Depreciation	4	316,468,788	317,369,687
Prior Period Expenses	22	35,948	867,802
TOTAL (B)		**914,646,480**	**887,084,898**
Balance being excess of Income over Expenditure (A-B)		**(210,902,622)**	**(206,512,101)**
Transfer to/ from Designated Fund			
Building Fund			
Others (Specify)			
BALANCE BEING SURPLUS/(DEFICIT) CARRIED TO CAPITAL FUND		**(210,902,622)**	**(206,512,101)**
Significant Accounting Policies	23		
Contingent Liabilities & Notes on Accounts	24		

INDIAN INSTITUTE OF SCIENCE EDUCATION AND RESEARCH
THIRUVANANTHAPURAM
SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st MARCH 2021

SCHEDULE 1- CORPUS/CAPITAL FUND: **(Amount-Rs.)**

	2020-21		2019-20	
Balance as at the beginning of the year		7,404,257,321		7,351,244,980
Add: Contributions towards Corpus/Capital Fund				
Add: Grant from UGC, Government of India and State Government to the extent utilised for capital expenditure	170,807,693		253,898,827	
Add: Assets purchased out of Earmarked funds				
Add: Assets purchased out of sponsored projects, where ownership vests in the institution				
Add: Assets donated/ gifts received				
Add: Other additions	102,925		5,625,615	
Add: Excess of income over expenditure transferred from income and expenditure account	(210,902,622)		(206,512,101)	
Total		**7,364,265,317**		**7,404,257,321**
Less: Deficit transferred from the income and expenditure account				
BALANCE AT THE YEAR-END		**7,364,265,317**		**7,404,257,321**

SCHEDUEL 2-DESIGNATED/ EARMARKED FUNDS **(Amount-Rs.)**

	FUND-WISE BREAK UP				TOTAL	
	Fund AAA	**Fund BBB**	**Fund CC**	**Endowment Funds**	**2020-21**	**2019-20**
A						
a) Opening balance of the funds						
b) Additions to the Funds:						
c) Income from investments made on account of funds						
d) Accrued interest on investments of the funds						
e) Interest on savings Bank Account						
f) Other additions (specify nature)						
TOTAL (A)	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**
B						
Utilisation/Expenditure towards objectives of funds						
i. Capital Expenditure						
ii. Revenue Expenditure						
TOTAL (B)						
CLOSING BALANCE AS AT THE YEAR-END (A-B)	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**
Represented by						
Cash and bank balances						
Investment						
Interest accrued but not due						
Total						

SCHEDULE 2 (A)-ENDOWMENT FUNDS

(Amount-Rs.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	
Sl. No	Name of the Endowment	Opening Balance		Additions during the year		Total		Expenditure on the object during the year	Closing Balance		Total (12)
		Endowment	Accumulated Interest	Endowment	Interest	Endowment	Accumulated Interest		Endowment	Accumulated Interest	
						(3)+(5)	(4)+(6)				(10)+(11)
1											
	Total	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**

SCHEDULE 3- CURRENT LIABILITIES AND PROVISIONS

	Sub Sch No.	2020-21	Sub Sch No.	2019-20
A. CURRENT LIABILITIES				
1. Deposits from staff				
2. Deposts from students				
3. Sundry Creditors:				
a) For Goods & Services	1		1	
b) Others	2	60,863,720	2	53,376,393
4. Deposits Others (including EMD, Security Deposits)	3	45,172,255	3	49,087,680
5. Statutory Liabilities(GPF,TDS,WC TAX, CPF, GIS,NPS) :				
a) Overdue				
b) Others	4	4,121,260	4	3,807,468
6. Other current Liabilities	5	429,974,455	5	382,577,469
a) Salaries				
b) Receipts against sponsored projects				
c) Receipts against sponsored fellowships and				
d) Unutilised Grants				
e) Grants in advance				
f) Other Funds				
g) Other liablities				
Total (A)		**540,131,690**		**488,849,010**
B. PROVISIONS				
1. For Taxation				
2. Gratuity				
3. Superannuation/Pension				
4. Accumulated Leave Encashment	6	86,915,271		81,776,332
5. Trade Warranties/Claims				
6. Others (Specify)				
Total (B)		86,915,271		81,776,332
Total (A+B)		**627,046,961**		**570,625,342**

INDIAN INSTITUTE OF SCIENCE EDUCATION AND RESEARCH
THIRUVANANTHAPURAM
SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st MARCH 2021

SCHEDULE 3 (a)-ENDOWMENT FUNDS (Sponsored Projects)

Amount in Rupees

(1)	(2)	(3)	(4)	(5)	(6)	(7)		(8)	(9)
Sl. No	Name of the Project	Opening Balance 2019-20		Receipts / Recoveries during the year	Total	Expenditure during the year		Closing Balance 2020-21	
		Credit	Debit			Recurring	Capital	Credit	Debit
1	CEFIPRA-DR.ARCHANA PAI-IFC/A/5504-1/2016-11	4809		154	4963			4963	
2	CSIR- DR.TAPAS K MANNA-37(1688)/17-EMR-II	45530		1930	47460	112163			64703
3	CSIR-CCMB-DR.RAVI M-31-2(281)/2018-19/Budget	690325		21972	712297			712297	
4	CSIR-DR.D.V.SENT.KUM-03(1400)/17/EMR-11	205259		6532	211791			211791	
5	CSIR-DR.SHADAK ALEE-03(1457)/19/EMR-II	1782270		42295	1824565	72019	1525451	227096	
6	DAE-DR RAMESH CHANDRANATH-37(3)/14/26/2017	31958		853533	885491	543439		342052	
7	DBT -IISC-MOHAMMED AIYAZ	253704		601260	854964	606424		248540	
8	DBT-A1-DR.HEMASOMANATHAN-BT/PR12720/COE/34/21/2015	657003		18463	675466	162695		512771	
9	DBT-A2-DR.HEMASOMANATHAN-BT/PR12720/COE/34/21/2015	799604		21294	820898	273703		547195	
10	DBT-A3-DR.ULLASA.K-BT/PR12720/COE/34/21/2015	488045		10127	498172	326697		171475	
11	DBT-DR TAPAS K MANNA-BT/HRD/NWB/38/2019-20(7)	501956		10435	512391	418113	166308		72030
12	DBT-DR.MAHESH HARIHARAN-BT/PR/5761/NNT/28/599/2012	128790		4099	132889			132889	
13	DBT-DR.REJI VARGHESE-BT/PR30172/MNT/28/1593/2018	235203		1304831	1540034	807864		732170	
14	DBT-DR.SUHESHKUMARSINGH-BT/PR30005-2018	7955829		871218	8827047	478869	7793368	554811	
15	DBT-DR.TAPAS K.MANNA-BT/PR30271-2018	10723198		1904388	12627586	1298264	8267080	3062243	
16	DBT-DR.ULLASA.K-BT/PR7713/NDB/39/261/2013	120955			120955	100000		20955	
17	DBT-DR.ULLASA-BT/PR27535/2018	330377		11273	341650	45531		296119	
18	DBT-EU-INF/15/RV/19-20/DR STALIN RAJ	0		3501860	3501860	764402		2737458	
19	DBT-RAMALING.-DR.NONG.SADAN-BT/RLF-RE-ENTRY/17/2015	329495		503476	832971	779790		53181	
20	DBT-RICE DR KALIKAPRASAD RESEARCH ASSOCIATESHIP PRG	1516411		31601	1548012	1408468		139544	
21	DBT-SRINIVASAMURTY-BT/PR21325/BRB/10/1554/2016		371532	2214969	1843437	2227319	15750		399632
22	DBT-TAPASKUMAR-BT/PR12514/BRB/10/1352/2014-(NEW)	28773		915	29688			29688	
23	DST INSPIRE FACULTY AWARDMAMTHASAHOO-/2013/PH-66	235		8	243			243	
24	DST(NANOMISSION)K GEORGETHOMAS/SR/NM/NS-23/2016-C	2636673		61051	2697724	1985484	468654	243585	
25	DST-DR M M SHAIJUMON-DST/TMD/HFC/2K18/136(C)&(G)	2584896		47150	2632046	530060	1803585	298401	
26	DST-DR MADHU THALAKULAM-ICPS/QUST/THEME-4/2019	0		90415184	90415184	1818818	169003	88427363	
27	DST-DR.A.MUTHUKRISHNAN-DST/TMD/HFC/2K18/24	2774719		-6511	2768208	708129	2100000		39921
28	DST-DR.TAMIL SEL-SR/WOS-A/CS-105/2016(G)	79627		-8990	70637	62224		8413	
29	DST-FIST-DR MAHESH-5751/IFD/2016-2017	35246941		742567	35989508		285933	35703575	
30	DST-HOD-SOP-FIST-SR/FST/PS-II/2018/54 ()	24572600		393235	24965835			24965835	

Amount in Rupees

(1)	(2)	(3)	(4)	(5)	(6)	(7)		(8)	(9)
Sl. No	Name of the Project	Opening Balance 2019-20		Receipts / Recoveries during the year	Total	Expenditure during the year		Closing Balance 2020-21	
		Credit	Debit			Recurring	Capital	Credit	Debit
31	DST-INSPIRE FACULTY AWARD-DR.SRILAKSHMI-2013/MA-23	22098		703	22801			22801	
32	DST-INSPIRE FACULTY AWARD-DR.ULLASA.K-IFA13-LSBM-92	84284			84284	84284		0	
33	DST-INSPIRE FACULTY FELLOWSHIP-DR MATHEW ARUN THOM	0		2203976	2203976	607537		1596439	
34	DST-INSPIRE FACULTY FELLOWSHIP-DR SOORAJ K	0		2203922	2203922	611613		1592309	
35	DST-INSPIRE FACULTY-DR.S.GOKULNATH-FA12-CH-74		107172		-107172				107172
36	DST-INSPIRE FACULTY-DR.VINAYAK.K-04/2015/002111	1470715		1537917	3008632	201407	393496	2413729	
37	DST-INSPIREFACULTY-MITHUNMUKHER-2012/MA-20/18.10.13	26109		831	26940			26940	
38	DST-JSPS-DR.KUMARAGURUBARAN.S-DST/INT/JSPS/P-288/2019	89680		-378	89302			89302	
39	DST-JSPS-DR.SUKHENDU M-DST/INT/JSPS/P-285/2019	230053		83204	313257	30711		282546	
40	DST-NM-DR.VINAYAK KAMBLE-DST/NM/NT/2018/124		39111	988929	949818	958280	8142		16604
41	DST-QUEST/THEME-4/2019/GENERAL-DR ANIL SHAJI	0		12282769	12282769	1520000		10762769	
42	DST-QUEST-SUMMER SCHOOL-DR.ANIL SHAJI	0		2016060	2016060			2016060	
43	DST-RAMANUJAN-DR.JISHY VARGHESE-SR/S2/RJN-140/2011	32808		1043	33851			33851	
44	DST-RAMANUJAN-DR.RAMESH RASAPPAN-SB/S2/RJN-059/2015	58152		506894	565046	455726		109320	
45	DST-RAMANUJAN-DR.RAVI PANT-SB/S2/RJN-069/2014	645416		14141	659557	299315	169864	190378	
46	DST-RAMANUJAN-RAJEN.GORETI-SB/S2/RJN-071/2015	342586		442228	784814	540197		244617	
47	DST-SERI-DR MANOJ NAMB-DST/MD/SERI/S15(G)-(NEW)	319797		460683	780480	458327	320341	1812	
48	DST-SJF-DR.K.M.SURESHAN-DST/SJF/CSA-02/2012-13	2256393		68314	2324707	81298	853287	1390122	
49	DST-SJF-DR.SUNISH.K RADHAKRISH-DST/SJF/LSA-01/14-15	73		4	77			77	
50	DST-TMD-DR.DEEPSHIKA-DST/TMD/HFC/2K18/37	2600423		70842	2671265	417882	542850	1710533	
51	DST-TMD-MES-DR.M.M SHAIJUMON-2K16/114(G)	1700335		37880	1738215	1430817		307398	
52	DUPONT YOUNG PROFESSOR PROGRAM-DR.RAVI.M	1264997		36899	1301896	95738		1206158	
53	EICL-DR.M.M.SHAIJUMON	49864		1691	51555	29105		22450	
54	FIST PROJECT-SCHOOL OF BIOLOGY	22743006		400621	23143627		16057189	7086438	
55	GE INDIA INDUSTRIAL PVT LTD PROJECT-DR.RAJEEV KINI	479045		-35163	443882	5768		438114	
56	ICAR-DR.RAVI M-NASF/GT-7024/2018-19	101852		990902	1092754	502886		589868	
57	INDO-ITLIAN-DR.MAHESH HARI-INT/ITALY/P-2016(ER)	165903		5303	171206	7266		163940	
58	INSPIRE FACULTY AWARD- DR DHANYA RAJENDRAN			1176160	1176160	162892		1013268	
59	INSPIRE FACULTY AWARD-DR MANIK BANIK			973076	973076	73500		899576	
60	INSPIRE FACULTY FELLOWSHIP-DR FAZALURAHMAN			2200000	2200000	170224		2029776	

Amount in Rupees

(1)	(2)	(3)	(4)	(5)	(6)	(7)		(8)	(9)
Sl. No	Name of the Project	Opening Balance 2019-20		Receipts / Recoveries during the year	Total	Expenditure during the year		Closing Balance 2020-21	
		Credit	Debit			Recurring	Capital	Credit	Debit
61	ISRO-DEEPSHIKA/DS-2B-13012(2)42/2017-NEW		27700	720419	692719	491882	20170	180667	
62	ISRO-DR K M SURESHAN(NEW)			392040	392040	262488		129552	
63	ISRO-DR.DEEPSHIKHA JAISWAL NAGAR./19012/35/2016-II	130429		3146	133575	86256		47319	
64	IUSSTF-SHAIJUMON-JC-071/2017	53547		2262	55809	50805		5004	
65	JC BOSE-DR.K.GEORGE THOMAS-NEW	1096008		1428863	2524871	1593650	677464	253757	
66	JC BOSE-DR.K.GEORGE THOMAS-SB/S2/JCB-64/2013	15240			15240			15240	
67	KSCSTE(KSYSA)-DR.REJI VARG-008/KSYSA-RG/2015/CSTE		25222	768517	743295	734634		8661	
68	KSCSTE(KSYSA)RAJEEV N KINI-KSCSTE-431/2018-KSYSA-RG	12279		850958	863237	632400	82768	148069	
69	KSCSTE-DR.MAHESH HARIHARAN-007/KSYSA-RG/2014/CSTE	219343		6981	226324			226324	
70	KSCSTE-SWATHI-430/2018	412484		-247002	165482	84958		80524	
71	KSCSTE-DR SANDREA MAUREEN FRANCIS-NPDF			472400	472400			472400	
72	MHRD/STARS-DR VINESH VIJAYAN-STARS/APR2019/BS/708	993512		16223	1009735	1193356			183621
73	MHRD-COE-DR.AMAL MEDHI-(FN.NO.5-5/2014-TS.VII)	251188		7993	259181			259181	
74	MHRD-DR MANOJ NAMBOOTHIRI-STARS/APR2019/PS/308/FS	1548856		58376	1607232	1014131	530796	62305	
75	MHRD-STARS-DR RAVI MARUTHACHALAM-APR2019/BS/818/FS	1967000		34462	2001462	976047	406660	618755	
76	NBHM-PDF-DR.T.KATHIRAVAN	38449		1224	39673			39673	
77	OTHERS	3191503		595517	3787020	3095		3783925	
78	MTR-000483-DR VIJI Z THOMAS	0		220000	220000	125521		94479	
79	RAENG-DR.JOY MITRA	2819306			2819306	1471546		1347760	
80	SERB-001486 -DR SOUMEN DE			1654579	1654579	182051		1472528	
81	SERB- DR RAJEEV N KINI-CRG/2019/004865	1935561		48483	1984044	362503	1413660	207882	
82	SERB(NEW)-DR RAJEEV N KINI-IPA/2020/000021	3547000		77201	3624201	104914	1530308	1988979	
83	SERB(NEW)-DR UPTAL MANNA-MSC/2020/000029			436180	436180	63928		372252	
84	SERB-DR AJAY VENUGOPAL /CRG/2019/005040	186629		509083	695712	624328		71384	
85	SERB-DR GOKULNATH SAPABATHI-CRG/2019/006303	2347981		67059	2415040	710882	1600000	104158	
86	SERB-DR HEMA SOMANATHAN-CRG/2019/003805	967000		24963	991963	143230		848733	
87	SERB-DR JISHY VARGHESE-EMR/2016/004978	306285		1114395	1420680	763364	-52240	709556	
88	SERB-DR JOY MITHRA-CRG/2019/004965	3058954		91854	3150808	632696		2518112	
89	SERB-DR RAVI PANT-CRG/2019/000993	4365501		124970	4490471	377956	1000355	3112160	
90	SERB-DR SUDARSHAN KUMAR-MTR/2017/000649			160601	160601	148743		11858	

(1)	(2)	(3)	(4)	(5)	(6)	(7)		(8)	(9)
Sl. No	Name of the Project	Opening Balance 2019-20		Receipts / Recoveries during the year	Total	Expenditure during the year		Closing Balance 2020-21	
		Credit	Debit			Recurring	Capital	Credit	Debit
91	SERB-DR.A.KALIAMOORTHY-ECR/2016/000202	852		27	879			879	
92	SERB-DR.ALA.KALIYAMOORTY-EEQ/2016/000231	182963		642435	825398	559021		266377	
93	SERB-DR.ANIL SHAJI-EMR/2016/007221	791382		23537	814919	166486	98000	550433	
94	SERB-DR.BIKAS C DAS/ECR/2017/000630	113781		185408	299189	221747		77442	
95	SERB-DR.BIKAS CHANDRADAS-EEQ/2016/000045	52830		157009	209839	14896		194943	
96	SERB-DR.BINDUSAR SAHOO-CRG/2018/002373	636107		271589	907696	631550		276146	
97	SERB-DR.CHIRANJEEVI.P-SERB/EEQ/2016/000549	472437		15035	487472			487472	
98	SERB-DR.DEEPSHIKA JAISWAL NAGAR-YSS/2015/001743	65035		2069	67104			67104	
99	SERB-DR.DEVARAJ-MTR/2018/000559	4107		220688	224795	128590		96205	
100	SERB-DR.GEETHA T -MTR/2017/000424	94084		103659	197743	95466		102277	
101	SERB-DR DOND ASHA KISON-SRG/2020/001027			796362	796362	97496		698866	
102	SERB-DR.GOKULNATH-SERB/F/181/2016-17	6216		135762	141978			141978	
103	SERB-DR.HEMA SOMANATHAN/EMR/2014/000705	304999		4740	309739	204900		104839	
104	SERB-DR.K.M.SURESHAN-CRG/2018/000577	661129		1317130	1978259	1683683		294576	
105	SERB-DR.KALIKA PRASAD-EMR/2017/002503	333029		1023602	1356631	939034		417597	
106	SERB-DR.M.M.SHAIJUMON-EMR/2017/000484	459770		8594	468364	564881			96517
107	SERB-DR.MADHU THALAKULAM-CRG/2018/004213	763337		41176	804513	528170	212763	63580	
108	SERB-DR.MADHU THALAKULAM-SB/S2/CMP-008/2014	126393			126393			126393	
109	SERB-DR.MAHESH HARIHARAN-CRG/2019/002119	3423252		318274	3741526	382814	2672508	686205	
110	SERB-DR NAGAIAH CHAMAKURI-EMR/2017/000664			289403	289403	97317		192086	
111	SERB-DR NAGAIAH CHAMAKURI-MTR/2017/000598			174876	174876	12533		162343	
112	SERB-DR.N.SADANANDASINGH-ECR/2016/000979	512084		824204	1336288	1078129		258159	
113	SERB-DR.R.S. SWATHI/SB/WEA-14/2016	34904		-15446	19458	18595		863	
114	SERB-DR.RAJENDAR GORETI/ECR/2016/001580	176175		1883	178058	128576		49482	
115	SERB-DR RAGENDAR GORETI/CRG/003737			2264914	2264914	338309		1926605	
116	SERB-DR.RAMESH CH.NATH0 CRG/2019/000960	1056610		232638	1289248	946275		342973	
117	SERB-DR.RAMESH RASAPPAN-EMR/2015/001103	154643		4161	158804	68870		89934	
118	SERB-DR.RAVI PANT-EMR/2015/000363	67189		8001	75190			75190	
119	SERB-DR.SADANADA SINGH-EEQ/2018/001090	295895		909607	1205502	978539		226963	
120	SERB-DR.SAIKAT CHATTERJEE/YSS/2015/001687	160601		4027	164628	47500		117128	

Amount in Rupees

(1)	(2)	(3)	(4)	(5)	(6)	(7)		(8)	(9)
Sl. No	Name of the Project	Opening Balance 2019-20		Receipts / Recoveries during the year	Total	Expenditure during the year		Closing Balance 2020-21	
		Credit	Debit			Recurring	Capital	Credit	Debit
121	SERB-DR.SAIKAT-MTR/2018/000528	2855		220620	223475	20000		203475	
122	SERB-DR.SARBESWAR PAL-EMR/2015/002172	9892		81498	91390	72553		18837	
123	SERB-DR.SRINIVASA MURTY/EMR/2016/008048	265157		607973	873130	604912		268218	
124	SERB-DR.SUBRATAKUNDU-ECR/2017/003200	76947		412217	489164	371965		117199	
125	SERB-DR.SUHESH KUMAR/ECR/2016/001232	122358		4167	126525			126525	
126	SERB-DR.SUKHENDU MANDAL-EMR/2016/007501(NEW)	5148581		955697	6104278	743793	5000000	360485	
127	SERB-DR.SUMIT MOHANTY/MTR/2017/000458		12755	231	-12524				12524
128	SERB-DR.TAPAS K MANNA-EMR/2016/001562	544,554		11,537	556091	543,314		12777	
129	SERB-DR TAPAS K MANNA-CRG/2020/002452			2249000	2249000	185700		2063300	
130	SERB-DR.THIRUMURUGAN.A-EMR/2016/002637	1152246		22727	1174973	837368		337605	
131	SERB-DR.UTPAL MANNA-MTR/2018/000034	110256		102264	212520	126002		86518	
132	SERB-DR.V.SIVARANJANA-ECR/2016/000226	6666		260	6926			6926	
133	SERB-DR.VINAYAK B KAMBLE-EEQ/2018/000769	1329022		339365	1668387	460766	898800	308821	
134	SERB-DR.VINESH VIJAYAN-EMR/2015/000111	43640		1389	45029			45029	
135	SERB-DR-NISHANT K T-CRG/2018/000916	1653271		47105	1700376	958703		741673	
136	SERB-IMPRINT DR GEORGE THOMAS SR/S9/Z-05/2015	5991633		-578980	5412653	3313202	423880	1675572	
137	SERB-IPA-000070 DR V STALIN RAJ			5885825	5885825	1209572		4676253	
138	SERB-MR.SOURAV BISWAS-PDF/2020/001085			1015536	1015536	368050		647486	
139	SERB-MS.SHRUTI SURIYAKUMAR-PDF/2020/000209			1015536	1015536	257123		758413	
140	SERB-MS.RESHMA BASAK-PDF/2020/000943			1012800	1012800	212436		800364	
141	SERB-VINESH VIJAYAN-CRG/2019/004880	723854		718364	1442218	1298763		143455	
142	SERB-WOS-A-SMITHA VISHNU-LS-457/2017(G)	29463		1053388	1082851	1031244		51607	
143	SPARC-DR.NISHANT K T	1361188		26786	1387974	540545		847429	
144	STARS- DR RAMANATHAN NATESH-STARS/APR2019/BS/726/FS			1969361	1969361	1150442	229318	589601	
145	STARS/APR2019/PS/363/FS- DR MADHU THALAKULAM(NEW)	3132000		80271	3212271	472045	2214358	525869	
146	STARS-DR AJAY VENUGOPAL-APR2019/CS/250/FS	453196		6350	459546	511559			52013
147	UGC-UKEIRI-JOYMITRA-184-16/2017(IC)-NEW	203659		7071	210730	145511		65219	
148	UGC-UKIERI-BIKAS CHANDRA DAS-4(I)/P-3Y-42/C	549999		18062	568061	24037		544024	
149	UGC-UKIERI-DR.JOY MITRA-184-26/2014(IC)	84691			84691			84691	
150	WT-DBT-DR.SATISH KHURANA-IA/1/15/2/502061	5121288		3477364	8598652	5690972	294630	2613051	

Amount in Rupees

(1)	(2)	(3)	(4)	(5)	(6)	(7)		(8)	(9)
Sl. No	Name of the Project	Opening Balance 2019-20		Receipts / Recoveries during the year	Total	Expenditure during the year		Closing Balance 2020-21	
		Credit	Debit			Recurring	Capital	Credit	Debit
151	WT-DBT-NISHA KANNAN/1A/E/15/1/502329	1028316		1190074	2218390	446854	425359	1346177	
152	WT-DR POONAM THAKUR			2561305	2561305	510518	1224728	826059	
153	WT-SABARI SANKAR THIRUPATHY	9356092		4045058	13401150	2366168	739521	10295461	

SCHEDULE 3 (B)-SPONSORED FELLOWSHIPS AND SCHOLARSHIPS

Amount in Rupees

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sl. No	Name of the Sponsor	Opening Balance as on 01.04.2020		Transactions during the year		Closing Balance as on 31.03.2021	
		Credit	Debit	Credit	Debit	Credit	Debit
1	DST - INSPIRE - BSMS/ PHD	12,154,260		11,806,269	12,737,662	11,222,867	
2	CSIR (Ph D Research Scholars)	1,805,656		500,000	245,387	2,060,269	
3	UGC (Ph D Research Scholars)	723,586		-	27,067	696,519	
4	DBT (Ph D Research Scholar)			203,750	287,500		83,750
5	PMRF (Ph D Research Scholars)	470000.00		5270484.00	3488000.00	2,252,484	
	Total	**15,153,502**	**-**	**17,780,503**	**16,785,616**	**16,232,139**	**83,750**

SCHEDULE 3(C)-UNUTILIZED GRANTS FROM UGC, GOVERNMENT OF INDIA AND STATE GOVERNMENTS

Amount in Rupees

		2019-20
A. Plan grants: Government of India (MHRD)		
Balance B/F	1,589,028,180	1,153,116,891
Add: Receipts during the year	605,000,000	1,238,000,000
Total (a)	2,194,028,180	2,391,116,891
Less Refunds		
Less: Utilized for Revenue Expenditure	593,002,805	568,847,409
Less: Utilized for Capital Expenditure	108,223,589	233,241,302
Total (b)	701,226,394	802,088,711
Unutilized carried forward (a-b)	**1,492,801,786**	**1,589,028,180**
B. UGC Grants: Plan		
Balance B/F		
Add: Receipts during the year		
Total (c)	NIL	NIL
Less Refunds		
Less: Utilized for Revenue Expenditure		
Less: Utilized for Capital Expenditure		
Total (d)	NIL	NIL
Unutilized carried forward (c-d)		
C. UGC Grants Non-Plan		
Balance B/F		
Add: Receipts during the year		
Total (e)	NIL	NIL
Less Refunds		
Less: Utilized for Revenue Expenditure		
Less: Utilized for Capital Expenditure		
Total (f)	NIL	NIL
Unutilized carried forward (e-f)		
D. Grants from State Govt.		
Balance B/F		
Add: Receipts during the year		
Total (g)	NIL	NIL
Less Refunds		
Less: Utilized for Revenue Expenditure		
Less: Utilized for Capital Expenditure		
Total (h)	NIL	NIL
Unutilized carried forward (g-h)		
Grand Total (A+B+C+D)	**1,492,801,786**	**1,589,028,180**

(Amount-Rs.)

SCHEDULE 4 - FIXED ASSETS (PLAN)

	DESCRIPTION	GROSS BLOCK				DEPRECIATION					NET BLOCK	
		Opening Balance as on 01.04.2020	Additions	Deductions	Closing Balance	Rate of Depreciation	Opening Balance	Depreciation for the year	Deductions / Adjustment	Total Depreciation	31.03.2021	31.03.2020
	TANGIBLE ASSETS											
1	**LAND:**											
	a) Freehold											
	Land obtained from Govt	1			1	0.00%					1	1
	Vithura	954,506			954,506	0.00%					954,506	954,506
2	Site Development	-			-							
3	BUILDINGS:	2,416,081,105	-	460,292	2,415,620,813	2.00%	152,840,644	48,312,416		201,153,060	2,214,467,753	2,263,240,461
4	Roads & Bridges	73,341,681	-	-	73,341,681	2.00%	7,045,511	1,466,834		8,512,345	64,829,336	66,296,170
5	Tubes & Water Supply	1,128,215	-	-	1,128,215	2.00%	45,128	22,564		67,692	1,060,523	1,083,087
6	Sewage & Drainage	-	-	-	-	2.00%	-	-		-	-	-
7	Electrical Installation and equipment	43,014,579	-	55,351	42,959,228	5.00%	10,183,028	2,149,622		12,332,650	30,626,578	32,831,551
8	Plant and Machinery	53,903,468	-	-	53,903,468	5.00%	17,180,378	2,695,173		19,875,551	34,027,917	36,723,090
9	Scientific & Laboratory Equipment	2,175,647,373	45,063,422	-	2,220,710,795	8.00%	840,621,242	177,385,057		1,018,006,299	1,202,704,496	1,335,026,131
10	Office Equipment	7,967,610	-	-	7,967,610	7.50%	1,107,895	597,571		1,705,466	6,262,144	6,859,715
11	Audio Visual Equipment	118,462	-	-	118,462	7.50%	12,259	8,885		21,144	97,318	106,203
12	Computers & Peripherals	175,004,537	2,739,593	-	177,744,130	20.00%	121,771,519	18,168,657		139,940,176	37,803,954	53,233,018
13	Furniture, Fixtures and Fittings	230,124,913	2,322,258	-	232,447,171	7.50%	63,787,303	17,433,538		81,220,841	151,226,330	166,337,610
14	VEHICLES	3,887,817	-	-	3,887,817	10.00%	1,513,175	318,677		1,831,852	2,055,965	2,374,642
15	Library Books & Scientific Journals	25,921,205	14,989	-	25,936,194	10.00%	19,954,200	1,631,553		21,585,753	4,350,441	5,967,005
16	Small Value Assets											
	TOTAL (A)	**5,207,095,472**	**50,140,262**	**515,643**	**5,256,720,091**		**1,236,062,282**	**270,190,547**	**-**	**1,506,252,829**	**3,750,467,262**	**3,971,033,190**
17	CAPITAL WORK-IN PROGRESS - Construction	2,551,082,850	24,859,013	-	2,575,941,863						**2,575,941,863**	**2,551,082,850**
17	CAPITAL WORK-IN PROGRESS - Lab Equipment	60,730,341	8,736,751	3,475,520	65,991,572						65,991,572	60,730,341
	CAPITAL WORK IN PROGRESS (B)										**2,641,933,435**	**2,611,813,191**
	TOTAL A+B										**6,392,400,697**	**6,582,846,381**

S.No.	INTANGIBLE ASSETS	GROSS BLOCK				DEPRECIATION					NET BLOCK	
		Opening Balance as on 01.04.2020	Additions	Deductions	Closing Balance	Rate of Depreciation	Opening Balance	Amortization for the year	Deductions / Adjustment	Total Amortization / Adjustments	31.03.2021	31.03.2020
18	Computer Software	20,877,707	386,576	17,000	21,247,283	40.00%	19,878,248	818,070	-	20,696,318	550,965	999,459
19	E-Journals	430,249,633	27,961,800	-	458,211,433	40.00%	393,866,844	38,450,956	-	432,317,800	25,893,633	36,382,789
20	Patents	176,500	147,350	-	323,850	9 Years	39,222	35,983	-	75,205	248,645	137,278
	TOTAL -(C)	**451,303,840**	**28,495,726**	**17,000**	**479,782,566**		**413,784,314**	**39,305,009**	**-**	**453,089,323**	**26,693,243**	**37,519,526**
	GRAND TOTAL (A+B+C)	**8,270,212,503**	**112,231,752**	**4,008,163**	**8,378,436,092**		**1,649,846,596**	**309,495,556**	**-**	**1,959,342,152**	**6,419,093,940**	**6,620,365,907**

(Amount-Rs.)

SCHEDULE 4 A - FIXED ASSETS (PLAN+NON PLAN)

	DESCRIPTION	GROSS BLOCK				DEPRECIATION					NET BLOCK	
		Opening Balance as on 01.04.2020	Additions	Deductions	Closing Balance	Rate of Depreciation	Opening Balance	Depreciation for the year	Deductions / Adjustment	Total Depreciation	31.03.2021	31.03.2020
	TANGIBLE ASSETS											
1	**LAND:**											
	a) Freehold											
	Land obtained from Govt	1			1	0.00%					1	1
	Vithura	954,506			954,506	0.00%					954,506	954,506
2	Site Development	-			-							
3	BUILDINGS:	2,416,081,105	-	460,292	2,415,620,813	2.00%	152,840,644	48,312,416		201,153,060	2,214,467,753	2,263,240,461
4	Roads & Bridges	73,341,681	-	-	73,341,681	2.00%	7,045,511	1,466,834		8,512,345	64,829,336	66,296,170
5	Tubes & Water Supply	1,128,215	-	-	1,128,215	2.00%	45,128	22,564		67,692	1,060,523	1,083,087
6	Sewage & Drainage	-	-	-	-	2.00%	-	-		-	-	-
7	Electrical Installation and equipment	43,014,579	-	55,351	42,959,228	5.00%	10,183,028	2,149,622		12,332,650	30,626,578	32,831,551
8	Plant and Machinery	53,903,468	-	-	53,903,468	5.00%	17,180,378	2,695,173		19,875,551	34,027,917	36,723,090
9	Scientific & Laboratory Equipment	2,175,647,373	45,063,422	-	2,220,710,795	8.00%	840,621,242	177,385,057		1,018,006,299	1,202,704,496	1,335,026,131
10	Office Equipment	7,967,610	-	-	7,967,610	7.50%	1,107,895	597,571		1,705,466	6,262,144	6,859,715
11	Audio Visual Equipment	118,462	-	-	118,462	7.50%	12,259	8,885		21,144	97,318	106,203
12	Computers & Peripherals	175,004,537	2,739,593	-	177,744,130	20.00%	121,771,519	18,168,657		139,940,176	37,803,954	53,233,018
13	Furniture, Fixtures and Fittings	230,124,913	2,322,258	-	232,447,171	7.50%	63,787,303	17,433,538		81,220,841	151,226,330	166,337,610
14	VEHICLES	3,887,817	-	-	3,887,817	10.00%	1,513,175	318,677		1,831,852	2,055,965	2,374,642
15	Library Books & Scientific Journals	25,921,205	14,989	-	25,936,194	10.00%	19,954,200	1,631,553		21,585,753	4,350,441	5,967,005
16	Small Value Assets											
	TOTAL (A)	**5,207,095,472**	**50,140,262**	**515,643**	**5,256,720,091**		**1,236,062,282**	**270,190,547**	**-**	**1,506,252,829**	**3,750,467,262**	**3,971,033,190**
17	CAPITAL WORK-IN PROGRESS - Construction	2,551,082,850	24,859,013	-	2,575,941,863						**2,575,941,863**	**2,551,082,850**
17	CAPITAL WORK-IN PROGRESS - Lab Equipment	60,730,341	8,736,751	3,475,520	65,991,572						65,991,572	60,730,341
	CAPITAL WORK IN PROGRESS (B)										**2,641,933,435**	**2,611,813,191**
	TOTAL A+B										**6,392,400,697**	**6,582,846,381**

S.No.	INTANGIBLE ASSETS	GROSS BLOCK				DEPRECIATION					NET BLOCK	
		Opening Balance as on 01.04.2019	Additions	Deductions	Closing Balance	Rate of Depreciation	Opening Balance	Amortization for the year	Deductions / Adjustment	Total Amortization / Adjustments	31.03.2021	31.03.2020
18	Computer Software	20,877,707	386,576	17,000	21,247,283	40.00%	19,878,248	818,070	-	20,696,318	550,965	999,459
19	E-Journals	430,249,633	27,961,800	-	458,211,433	40.00%	393,866,844	38,450,956	-	432,317,800	25,893,633	36,382,789
20	Patents	176,500	147,350	-	323,850	9 Years	39,222	35,983	-	75,205	248,645	137,278
	TOTAL -(C)	**451,303,840**	**28,495,726**	**17,000**	**479,782,566**		**413,784,314**	**39,305,009**	**-**	**453,089,323**	**26,693,243**	**37,519,526**
	GRAND TOTAL (A+B+C)	8,270,212,503	112,231,752	4,008,163	8,378,436,092		1,649,846,596	309,495,556	-	1,959,342,152	6,419,093,940	6,620,365,907

(Amount-Rs.)

SCHEDULE 4 B FIXED ASSETS (NON PLAN)

	DESCRIPTION	GROSS BLOCK				DEPRECIATION					NET BLOCK	
		Opening Balance as on 01.04.2020	Additions	Deductions	Closing Balance	Rate of Depreciation	Opening Balance	Depreciation for the year	Deductions / Adjustment	Total Depreciation	31.03.2021	31.03.2020
	TANGIBLE ASSETS											
1	**LAND:**											
	a) Freehold											
	Land obtained from Govt Vithura											
2	Site Development											
3	BUILDINGS:											
4	Roads & Bridges											
5	Tubes & Water Supply											
6	Sewage & Drainage											
7	Electrical Installation and equipment											
8	Plant and Machinery											
9	Scientific & Laboratory Equipment											
10	Office Equipment											
11	Audio Visual Equipment											
12	Computers & Peripherals											
13	Furniture, Fixtures and Fittings											
14	VEHICLES											
15	Library Books & Scientific Journals											
16	Small Value Assets											
	TOTAL (A)	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**
17	CAPITAL WORK-IN PROGRESS (B)											

S.No.	INTANGIBLE ASSETS	GROSS BLOCK				DEPRECIATION					NET BLOCK	
		Opening Balance as on 01.04.2020	Additions	Deductions	Closing Balance	Rate of Depreciation	Opening Balance	Amortization for the year	Deductions / Adjustment	Total Amortization / Adjustments	31.03.2021	31.03.2020
18	Computer Software											
19	E-Journals											
20	Patents											
	TOTAL -(C)	-	-	-	-		-	-	-	-	-	-
	GRAND TOTAL (A+B+C)	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**

(Amount-Rs.)

	SCHEDULE 4 C - INTANGIBLE ASSETS												
	DESCRIPTION	GROSS BLOCK				DEPRECIATION					NET BLOCK	
		Opening Balance as on 01.04.2020	Additions	Deductions	Closing Balance	Rate of Depreciation	Opening Balance	Depreciation for the year	Deductions / Adjustment	Total Depreciation	31.03.2021	31.03.2020
1	Computer Software											
2	E-Journals											
3	Patents											
	TOTAL -(C)	-	-	-	-		-	-	-	-	-	-
	GRAND TOTAL (A+B+C)	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL

(Amount-Rs.)

SCHEDULE 4C (i)- PATENTS AND COPYRIGHTS						
Description	**Op. Balance**	**Addition**	**Gross**	**Amortization**	**Net Block 2020-21**	**Net Block 2019-20**
A. Patents Granted 1. Balance as on 31.03.21 of patents obtained in (Original value- Rs. ……/- 2. Balance as on 31.03.21 of patents obtained in Original value- Rs. ……/- 3.. Balance as on 31.03.21 of patents obtained in (Original value- Rs. ……/- 4. Patents granted during the Current Year						
TOTAL	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**
Description	**Op. Balance**	**Addition**	**Gross**	**Patents Granted/ Rejected**	**Net Block 2020-21**	**Net Block 2019-20**
B. Patents Pending in respect of Patent applied for						
TOTAL	-	-	-	-		-
C. Grand Total (A+B)	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**

(Amount-Rs.)

SCHEDULE 4 D FIXED ASSETS (OTHERS)

	DESCRIPTION	GROSS BLOCK				DEPRECIATION					NET BLOCK	
		Opening Balance as on 01.04.2020	Additions	Deductions	Closing Balance	Rate of Depreciation	Opening Balance	Depreciation for the year	Deductions / Adjustment	Total Depreciation	31.03.2021	31.03.2020
	TANGIBLE ASSETS											
1	**LAND:**											
	a) Freehold											
	Land obtained from Govt				-	0.00%						
	Vithura				-	0.00%						
2	Site Development				-							
3	BUILDINGS:				-	2.00%				-	-	
4	Roads & Bridges				-	2.00%				-	-	
5	Tubes & Water Supply				-	2.00%				-	-	
6	Sewage & Drainage				-	2.00%				-	-	
7	Electrical Installation and equipment				-	5.00%				-	-	
8	Plant and Machinery				-	5.00%				-	-	
9	Scientific & Laboratory Equipment	17,910,183	63,423,822	839,718	80,494,287	8.00%	1,432,815	6,439,543		7,872,358	72,621,929	16,477,368
10	Office Equipment	-			-	7.50%	-	-		-	-	-
11	Audio Visual Equipment	59,832			59,832	7.50%	4,487	4,487		8,974	50,858	55,345
12	Computers & Peripherals	2,621,110			2,621,110	20.00%	524,222	524,222		1,048,444	1,572,666	2,096,888
13	Furniture, Fixtures and Fittings	66,400			66,400	7.50%	4,980	4,980		9,960	56,440	61,420
14	VEHICLES	-			-	10.00%	-			-	-	
15	Library Books & Scientific Journals	-			-	10.00%	-			-	-	
16	Small Value Assets											
	TOTAL (A)	**20,657,525**	**63,423,822**	**839,718**	**83,241,629**		**1,966,504**	**6,973,232**	**-**	**8,939,736**	**74,301,893**	**18,691,021**
17	CAPITAL WORK-IN PROGRESS (B)											

S.No.	INTANGIBLE ASSETS	GROSS BLOCK				DEPRECIATION					NET BLOCK	
		Opening Balance as on 01.04.2020	Additions	Deductions	Closing Balance	Rate of Depreciation	Opening Balance	Amortization for the year	Deductions / Adjustment	Total Amortization / Adjustments	31.03.2021	31.03.2020
18	Computer Software											
19	E-Journals											
20	Patents											
	TOTAL -(C)	**-**	**-**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**
	GRAND TOTAL (A+B+C)	**20,657,525**	**63,423,822**	**839,718**	**83,241,629**	**-**	**1,966,504**	**6,973,232**	**-**	**8,939,736**	**74,301,893**	**18,691,021**

SCHEDULE 5- INVESTMENTS **(Amount-Rs.)**

INVESTMENTS FROM EARMARKED/ENDOWMENT FUNDS	2020-21	2019-20
1. In Central Government Securities 2. In State Government Securities 3. Other approved Securities 4. Shares 5. Debentures and Bonds 6. Term Deposits with bank 7. Others (to be specified)		
TOTAL	**NIL**	**NIL**

INDIAN INSTITUTE OF SCIENCE EDUCATION AND RESEARCH THIRUVANANTHAPURAM
SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st MARCH 2021

SCHEDULE 5(A)- INVESTMENTS FROM EARMARKED/ ENDOWMENT FUNDS (FUND WISE)

(Amount-Rs.)

	2020-21	2019-20
1. Endowment Fund Investment		
TOTAL	**NIL**	**NIL**

SCHEDULE 6- INVESTMENTS OTHERS **(Amount-Rs.)**

	2020-21	2019-20
1. In Central Government Securities 2. In State Government Securities 3. Other approved Securities 4. Shares 5. Debentures and Bonds 6. Others (to be specified)		
TOTAL	**NIL**	**NIL**

SCHEDULE 7- CURRENT ASSETS

(Amount-Rs.)

	Sub Sch. No.	2020-21	2019-20
1. Stock			
a) Stores and Spares			
b) Loose Tools			
c) Publications			
d) Laboratory Chemicals, consumables and glass wares			
e) Building materials			
f) Electrical materials			
g) Stationery			
h) Water supply material			
2. Sundry Debtors:			
a) Debts Outstanding for a period exceeding six months			
b) Others			
3. Cash balances in hand (including cheques/drafts and imprest)	1		-
4. Bank Balances:			
Institute balance			
a) With Scheduled Banks:			
-On Current Accounts	2	847,800	4,602,637
-On Term Deposit Accounts (includes margin money)	2	641,515,700	622,666,086
-On Savings Accounts	2	39,759,046	117,561,917
b) With non-Scheduled Banks:			
-On Current Accounts			
-On Term Deposit Accounts			
-On Savings Accounts			
Project Balance			
a) With Scheduled Banks:			
-On Current Accounts			
-On Term Deposit Accounts (includes margin money)	2	78,515,413	19,609,579
-On Savings Accounts	2	213,433,120	218,352,769
b) With non-Scheduled Banks:			
-On Current Accounts			
-On Term Deposit Accounts			
-On Savings Accounts			
5. Post Office- Savings Accounts			
TOTAL		**974,071,079**	**982,792,988**

SCHEDULE 8- LOANS, ADVANCES & DEPOSITS **(Amount-Rs.)**

	Sub Sch. No.	2020-21	2019-20
1. Advances to employees: (Non interest bearing)			
a) Salary			
b) Festival			
c) Medical Advance			
d) Other (to be specified)			
2. Long Term Advances to employees: (Interest bearing)			
a) Vehicle Loan			-
b) Home Loan			
c) Others (to be specified)			
3. Advances and other amounts recoverable in cash or in kind or for value to be received			
a) On Capital Account			
b) To suppliers			
c) Others	4	2,172,828,080	2,053,961,902
4. Prepaid Expenses			
a) Insurance			
b) Other Expenses	3	5,021,071	685,207
5. Deposits			
a) Telephone			
b) Lease Rent			
c) Electricity			
d) AICTE, if applicable			
e) Others (to be specified)			
6. Income Accrued:			
a) On Investments from Earmarked/Endowment Funds			
b) On Investments-Others			
c) On Loans and Advances			
d) Others (includes income due unrealized-Rs……)	5	21,813,253	23,693,845
7. Other Current Assets Recievables			
a) Debit balances in sponsered projects	8	1,044,737	583,493
b) Debit balances in fellowship & scholarships			
c) Grants recoverable			
d) Other recievables			
e) TDS	7	304,488	458,594
8. Claims Receivable	6	86,883,506	86,154,843
TOTAL		**2,287,895,135**	**2,165,537,884**

	2020-21	2019-20
SCHEDULE 9- ACADEMIC RECEIPTS		
FEE FROM STUDENTS		
Acadamic		
a) Tuition fee	55,646,167	40,598,215
b) Admission fee		
c) Enrolment fee		
d) Library fee	75,349	686,030
e) Laboratory fee		
f) Art & Craft fee		
g) Registration fee	557,275	559,900
h) Syllabus fee		
i) Other Receipts	228,447	859,255
j) Alumini Fee	74,250	143,450
TOTAL (A)	56,581,488	42,846,850
Examinations		
a) Admission test fee		
b) Annual examination fee	637,283	773,680
c) Mark sheet, Certificate fee		
d) Entrance Examination fee		
TOTAL (B)	637,283	773,680
Other Fee		
a) Identity Card fee		
b) Fine/ Miscellaneous fee		
c) Medical fee		
d)Transportation fee		
e)Hostel Fee	463,192	2,404,850
f)Mess Establishment	304,500	777,000
TOTAL (C)	767,692	3,181,850
Sale of publications		
a) Sale of admission forms		
b) Sale of syllabus and question paper		
c) Sale of prospectus including admission forms		
TOTAL (D)		
Other Accademic Receipts		
a) Registration fee for workshops programmes		
b) Registration fees (Academic Staff College)		
GRAND TOTAL (A+B+C+D)	**57,986,463**	**46,802,380**

			2020-21	2019-20
SCHEDULE 10- GRANTS/ SUBSIDIES				
(Irrevocable Grants & Subsidies Received)				
Balance B/F			1,589,028,180	1,153,116,892
ADD: Receipts During the Year				
Capital Grant			605,000,000	1,238,000,000
	General	-		
	SC	-		
	ST	-		
Revenue Grant				
	General	534,500,000		
	SC	45,800,000		
	ST	24,700,000		
			2,194,028,180	**2,391,116,892**
Less: Capital Expenses Incurred during the year			108,223,589	233,241,302
Less: Closing Unspent balance of grant			1,492,801,786	1,589,028,181
			593,002,805	**568,847,409**
TOTAL			**593,002,805**	**568,847,409**

SCHEDULE 11- INCOME FROM INVESTMENTS

(Amount-Rs.)

	Earmarked or Endownment funds		Other investments	
	2020-21	2019-20	2020-21	2019-20
1) Interest a) On Govt. Securities b) Other Bonds/Debentures 2) Interest on term deposits 3) Income Accrued but not due on term deposits or interest bearing advances to employees 4) Interest on Savings Bank Accounts 5) Others (Specify)				
TOTAL	NIL	NIL	NIL	NIL
TRANSFERRED TO EARMARKED/ENDOWMENT FUNDS				
Balance	NIL	NIL	NIL	NIL

SCHEDULE 12- INTEREST EARNED

(Amount-Rs.)

Particulars	2020-21	2019-20
1) On Savings Accounts with scheduled banks 2) On Loans a. Employees/ Staff b. Others 3) On debtors and others receivables		
TOTAL	-	-

SCHEDULE 13- OTHER INCOME	(Amount-Rs.)	
	2020-21	2019-20
A. Income from Land & Building		
a) Hostel room rent	4,053,966	6,539,850
b) License fee	745,044	498,970
c) Hire charges of Auditorium/ Play ground/ Convention Centre, Etc		
d) Electricity Charges recovered	359,750	1,334,340
e) Water Charges recovered		
Total	**5,158,760**	**8,373,160**
B. Sale of Institutes Publications		
Total	-	-
C. Income from Holding Events		
a) Gross recieptS from annual function/ sports carnival		
Less: Direct expenditure incurredon the annual function/ sports carnival		
b) Gross recieptS from fetes		
Less: Direct expenditure incurred on fetes		
c) Gross recieptS on educational tours		
Less: Direct expenditure incurred on tours		
d) Others (to be specify and separately disclosed)		
Total	-	-
D. Interest On Term Deposits:		
a) With Scheduled Banks	40,822,297	48,050,405
b) With Non-Scheduled Banks		
c) With Institutions		
d) Others		
Total	**40,822,297**	**48,050,405**
E. Interest On Savings Accounts:		
a) With Scheduled Banks	623,274	
b) With Non-Scheduled Banks		
c) With Institutions		
d) Others		
Total	**623,274**	-
F. On Loans:		
a) Employees/Staff		
b) Others		
Total	-	-
G.Interest on Debtors and Other Receivables		
Total	-	-
H. Others		
a) Income from consultancy		
b) RTI Fees	85	140
c) Income from royalty		
d) Sale of application form	575,250	847,500
e) Misc. recieptS (Sale of tender form, waste paper, etc.)	5,574,924	7,651,803
f) Profit on sale/ disposal of Assets		
1. Owned asset		
2. Assets aquired out of grants, or received free of cost		
g) Other Incomes		
Total	**6,150,259**	**8,499,443**
GRAND TOTAL (A+B+C+D+E+F+G+H)	**52,754,590**	**64,923,008**

SCHEDULE 14 : PRIOR PERIOD INCOME

(Amount-Rs.)

Particulars	2020-21	2019-20
1. Academic Receipts		
2. Income from investments		
3. Interest earned		
4. Other Income		
Total	**NIL**	**NIL**

SCHEDULE 15- STAFF PAYMENT & BENEFITS

(Amount-Rs.)

	2020-21	2019-20
a) Salaries and Wages		239,742,535
Faculty - Rs.14,81,73,049	148,173,049	
Non Faculty	49,918,679	
b) Allowances and Bonus	6,018,711	5,299,049
c) Contribution to Provident Fund	-	
d) Contribution to Other Fund (Leave Salary & NPS Employer Share)	27,670,601	23,574,327
e) Staff Welfare Expenses	-	-
f) Retirement and Terminal Benefits	-	
g) LTC facility	3,208,974	2,586,123
h) Medical facility	2,342,495	2,322,260
i) Children Education Allowance	2,679,750	2,054,839
j) Honorarium	-	
k) Others (Leave Salary)	14,338,494	13,261,618
TOTAL	**254,350,753**	**288,840,751**

SCHEDULE 15 A- EMPLOYEES RETIREMENT AND TERMINAL BENEFITS

(Amount-Rs.)

	Pension	Gratuity	Leave Encashment	Total
Opening balance as on 01.04.2020			81,776,332.00	81,776,332
Additions: Capitalized value of contributions Received from other Organizations				
Total (a)			81,776,332.00	81,776,332.00
Less: Actual Payment during the Year (b)				
Balance available as on 31.03…. C (a-b)			**81,776,332.00**	**81,776,332.00**
Provision required on 31.03.2021 - As per Actuarial Valuation (d)				
A. Provision to be made in the curent year (d-c)			5,138,939.00	5,138,939.00
B. Contribution to New Pension Scheme				
C. Medical Reimbursement to Retired Employees				
D. Travel to Home town on Retirement				
E. Deposit Linked Insurance Payment				
TOTAL (A+B+C+D+E)	**NIL**	**NIL**	**86,915,271**	**86,915,271**

SCHEDULE 16- ACADEMIC EXPENSES		(Amount-Rs.)
Particulars	**2020-21**	**2019-20**
a) Laboratary Expenses	31,399,562	34,667,353
b) Field Work/ Participation		152,685
c) Expenses on Seminar/ Workshop		
d) Payment to visiting faculty		
e) Examination		
f) Student welfare expense		
g) Admission expenses		-
h) Convocation expense	2,740	1,095,791
i) Publication		
j) Stipend/ means-cum-merit scholarship	67,234,394	66,205,850
k) Subscription Expense		
l) Others (Specify)		
TOTAL	**98,636,696**	**102,121,679**

SCHEDULE 17- ADMINISTRATIVE AND GENERAL EXPENSES		(Amount-Rs.)
Particulars	**2020-21**	**2019-20**
A. Infrastructure		
a) Electricity and power	53,924,418	52,761,559
b) Water charges	7,010	17,074
c) Insurance	-	
d) Rent, Rates and Taxes	-	412,500
B. Communication		
e) Postage & Telegram	123,586	174,784
f) Telephone and Internet Charges	2,966,503	4,415,048
C. Others		
g) Printing and Stationary	1,075,336	1,915,976
h) Travelling and Conveyance Expenses	1,710,933	9,622,867
i) Expenses on Seminar/Workshops	210,927	2,160,997
j) Hospitality	-	
k) Auditors Remuneration	197,210	394,110
l) Professional Charges	-	
m) Advertisement and Publicity	625,715	1,301,566
n) Magazine & Journals	-	
o) Others (specify)		
Sports / Cultural Festival / Celeberation expense	240,869	3,545,183
Consumables	10,242,604	10,608,408
Cable TV Charges	38,829	138,720
Newspaper & Periodicals	42,984	136,835
Office contingencies		2,416,295
Software License fees	61,621	1,290,362
Publication charges	329,259	480,426
Manpower charges	64,907,724	
Guest house and other expenses	782,689	929,371
Other Adminstrative / Miscellaneous Expenses	5,732,084	5,746,867
Legal and consultancy charges	5,080,652	9,230,776
Anvesha Programme Expenses		306,254
Expenses related to COVID 19	1,386,356	185,504
Medical Centre - Consumables&Medicines	49,391	694,016
Running of Generator Set	1,476	384,677
IT recurring expenses for service	4,812,006	4,812,223
TOTAL	**154,550,182**	**114,082,398**

SCHEDULE 18- TRANSPORTATION EXPENSES **(Amount-Rs.)**

	2020-21	2019-20
1. Vehicles (owned by educational institution)		
a) Running expense	468,525	495,431
b) Repairs & Maintanence	291,087	132,612
c) Insurance Expenses	46,621	178,008
2. Vehicles taken on rent		
a) Rent/ Lease expenses	5,272,460	10,232,911
3. Vehicle (Taxi) Hiring expenses		
TOTAL	**6,078,693**	**11,038,962**

SCHEDULE 19- REPAIRS & MAINTANENCE **(Amount-Rs.)**

	2020-21	2019-20
a) Building	40,663,340	
b) Furniture & Fixtures	7,278,041	
c) Plant & Machinary	29,430,762	51,657,455
d) Office Equipments	34,776	
e) Computers		
f) Laboratory & Scientific equipment	1,391,672	
g) Audio Visual equipment		
h) Cleaning Material & Services		
i) Book binding charges		
j) Gardening		
k) Estate Maintenance		
f) Others (Specify)		
TOTAL	**78,798,591**	**51,657,455**

SCHEDULE 20- FINANCE COSTS **(Amount-Rs.)**

	2020-21	2019-20
a) Bank Charges b) Others (specify)	587,890	1,106,164
TOTAL	**587,890**	**1,106,164**

SCHEDULE 21- OTHER EXPENSES **(Amount-Rs.)**

	2020-21	2019-20
a) Provision for Bad and Doubtful debts/ Advances b) Irrecoverable Balances Wrtitten off c) Grants/ Subsidies to other institutions/ Organisations c) Others (Specify)		
TOTAL	**NIL**	**NIL**

SCHEDULE 22- PRIOR PERIOD EXPENSES **(Amount-Rs.)**

	2020-21	2019-20
1. Establishment Expenses 2. Academic Expenses 3. Administration Expenses 4. Transportation Expenses 5. Repair & Maintenance 6. Other Expenses	35,948	867,802
TOTAL	35,948	867,802

Schedule 23

Significant Accounting Policies

1. Basis for preparation of Accounts:

The Annual Accounts of the institute are prepared on the basis of revised format and guidelines issued by the Ministry of Education, Government of India and approved by the C&AG of India for all Central Educational Institutes with effect from financial year 2014-15 (Communicated vide Lr.No.29-4/2012-IFD dated 17.04.2015 of MHRD, GOI).

2. Accounting Convention:

The financial statements are prepared on the basis of Historical Cost Convention and ongoing concern concept unless otherwise stated. The institute follows accrual method of accounting.

3. Revenue Recognition:

The institute is significantly funded by the Ministry of Education (MOE), Government of India. The Government release the Grants-in-Aid under two major heads i.e., Capital and Revenue. Grants-in-Aid from GOI is accounted for in the same financial year for which it is sanctioned by the MOE.

Government Grants to the extent utilized for meeting revenue expenditure on accrual basis are treated as revenue income of the year and depicted in the Income and Expenditure Account.Admission fees, Tuition Fees and other fees received from students are accounted on accrual basis.Interest on Fixed Deposits has been credited in the accounts on accrual basis. No interest bearing advances for House Building, Purchase of Vehicles etc., has been sanctioned to staff to the said period.

4. Fixed Assets and Depreciation

The fixed assets are valued at cost of acquisition and inclusive of inward freight, duties, taxes, incidental and direct expenses related to acquisition.No fixed asset has been received directly by way of non-monetary grant during the year under consideration.The land at Jersey Farm, Vithura Nedumangad Taluk, Thiruvananthapuram District has been given by the Government of Kerala at no cost, hence the same has been shown at nominal value of Rs.1/- in Annual Account.No gifted / donated assets and Books have been received during the year under consideration.Fixed Assets are valued at cost less accumulated depreciation. No change has been made in the method and depreciation on fixed assets has been provided on Straight Line Method at the following rates:

Tangible Assets:

1.	Land		0%
2.	Site Development		0%
3.	Buildings		2%
4.	Roads and Bridges		2%
5.	Tube wells and water supply	2%	
6.	Sewerage and Drainage	2%	
7.	Electrical installation and equipment	5%	
8.	Plant and Machinery	5%	
9.	Scientific and Laboratory Equipment	8%	
10.	Office Equipment		7.5%
11.	Audio Visual Equipment	7.5%	
12.	Computer and Peripherals	20%	

13.	Furniture, Fixtures and Fittings	7.5%
14.	Vehicles	10%
15.	Library Books and Scientific Journals	10%

Intangible Assets (Amortization)

1.	E-Journals	40%
2.	Computer Software	40%
3.	Patents and Copyrights	9 Years

Depreciation is provided for the whole year on additions during the year for acquisition period of six months and above and for half year on additions for acquisition period of less than six months.Where an asset is fully depreciated, it will be shown at a residual value of Rs.1/- in the Balance Sheet and will not be further depreciated.

Assets created out of Earmarked Funds and Funds of Sponsored Projects where the ownership of such assets vests in the Institution will be setup by credit in Capital Fund and merged with the Fixed Assets of the institution. Depreciation charged at the rates applicable to the respective assets. Accordingly, assets of Sponsored Projects from 2019-20 shown in Schedule 4-D Fixed Assets (Others).Patents, copyrights and E Journals are grouped under intangible assets.

Electronic Journals (E-Journals) are separated from Library Books in view of the limited benefit that could be derived from the on-line access provided. E-Journals are not in a tangible form, but temporarily capitalized in view of the magnitude of expenditure and the benefit derived in terms of perpetual knowledge acquired by the Academic and Research Staff. Depreciation is provided in respect of E-Journals at a higher rate of 40% as against depreciation of 10% provided in respect of Library Books.Software and Computer Peripherals are being shown under the Fixed Assets.

Stocks:

Expenditure on purchase of Chemicals, Lab ware, Office Consumables, Publications and other consumable items are accounted as revenue expenditure. Such items issued to Labs are treated as consumed and hence closing stock is taken as NIL.

Retirement Benefits:

All employees of the Institute are covered under the New Pension Scheme. As such no provision has been made for pension, gratuity however suitable provision on the basis of actuarial valuation has been made for the Earned Leave Encashment vide Schedule No.15 A. No long term or Short Term Investments are made by the institute in Government Securities, Bonds, Debentures and Shares.

Corpus / Earmarked / Designated Endowment Funds:

The funds of the institute are classified into following categories:

1. Corpus / Capital Fund:

It refers to fund contributed by Government for establishment and activities of the institute. Corpus / Capital fund is the main fund of the institute and it denotes a permanent fund kept for the existence of the institute. The additions to this fund are Grants from Government to the extent utilised for Capital Expenditure. Assets purchased out of earmarked funds and sponsored project funds and excess of income over expenditure transferred from Income and Expenditure account.

Government Grants:

Plan grants received from Government are accounted on accrual basis.To the extent utilised towards capital expenditure, Government Grants are transferred to the Capital Fund.Unutilised Government Grants are carried forwarded and depicted under Current Liability in the Balance Sheet.

Capital Work-In Progress:

Deposit works are accounted for as Capital Work-in-Progress on the basis of statements received from Works Wing. Running Bills of Contractors are also accounted for as construction work in progress till completion. No depreciation is charged on Capital work in progress. Secured advances and Mobilization advances and Deposit work with CPWD are disclosed separately under the heads Loans and Advances.

Sponsored Projects:

The amount received under Sponsored Projects has been separately shown in Schedule 3 A. The period of manpower expenditure under externally funded projects considered as April to March from the FY 2020-21. The fellowships and scholarships funded by the UGC, CSIR, DBT,DST INSPIRE etc., are also shown separately in Schedule 3B. The Fellowships and Scholarships provided by the institute itself are accounted as Academic expenses.

Income Tax:

The income of the institute is exempt from Income Tax under Section 10 23 (C)(iii ab) of the Income Tax Act 1961. No provision for tax is therefore made in the accounts.

Foreign Currency transactions:

Foreign Currency transactions are accounted for at the rate of exchange prevailing on the dates of such transactions.

(B.V.Ramesh)
Deputy Registrar (F&A)

Schedule 24 – Contingent Liabilities and Notes on Accounts

The financial statement of the institute is prepared in three parts:

i) Receipt and Payment Account
ii) Income and Expenditure Account
iii) The Balance Sheet.

The Receipts and Payments Account consists of the figures of actual receipts and payments of the institute during the financial year 2020-21 as per Cash Book. The total receipts from the different sources as shown in Receipt and Payment Account includes grant of Rs.60.50 cr. received from Ministry of Education (MOE).

The Income and Expenditure Account is prepared on accrual basis. In Balance Sheet the acquired fixed assets, current assets are taken as assets while the Corpus Fund, Designated Fund, Endowment Funds, balance of Sponsored Projects and Grants received from Government and Current Liabilities etc., are shown in respective Schedules under Sources of Funds / Liabilities. Figures in Final Accounts have been rounded off to the nearest rupee.

In Schedule 10 the unspent balance of grant for the year 2019-20 rounded off to Rs.1,58,90,28,181, to this effect corresponding entry reflected in Schedule 3-C is Rs.1,58,90,28,180. The round off difference of Rs.1/- has been rectified in Schedule of 10 during the financial year 2020-21.

Schedule 1 to 22 are annexed and they form an integral part of Annual Accounts.

Expenditure related to hostel running expenses included in Schedule 17 – Administrative and General expenses.
As per MOE guidelines method of computing of depreciation is Straight Line Method.
The details of balances in Saving Bank, Current Accounts and in Fixed Deposit Accounts are given in Schedule 7 of the Balance Sheet.

During the financial year 2020-21, some small value assets / spare parts procured has been shown as consumable in the accounts being treated as augmentation to the Scientific / Lab equipment.
The unutilized grant shown under Schedule 3(C) Plan Grants from MHRD is Rs.149.28 cr. out of which advance payment made to CPWD as Deposit work for construction of IISER Permanent Campus vide Balance Sheet Sub Schedule 4.
An appeal was filed against M/s. Consolidated Construction Consortium Ltd. (CCCL) before the Hon'ble High Court of Kerala challenging the award of arbitrator vide O.P(Arb.) No.446/2018. Institute have deposited B.G for 1/4th of the award amount in the court on 1.1.2019 as per the directions of the Sessions Court and the matter is posted for further hearing.

Sponsored Project Accounts:

The institute has received grants from DST, DBT, Wellcome Trust DBT Alliance Fellowships, DAE, ISRO, CSIR, UGC etc., in Research and Development (R&D) Projects. A separate bank account is maintained for Sponsored R & D Projects. The transactions of Sponsored Projects and Project wise closing balances are being shown in Schedule 3(A) of the Balance Sheet. As per the funding agencies guidelines project wise bank account(s) are being maintained with IDBI Bank and Canara Bank separately. The treatment of Project Grant and its Utilisation is on Cash Basis.

Capital Works-in-Progress:

The construction work of institute's permanent campus situated at Jersey Farm, Vithura is under progress and expenditure related to the same is shown under Schedule 4 (Fixed Assets) of the Balance Sheet. The expenditure on capital work-in-progress as at 31.03.2021 was of Rs.2,64,19,33,435/-. Out of which construction is Rs.2,57,59,41863/- and uninstalled equipment procured during the period is Rs.6,59,91,572/-.

The **NPS** subscription recovered from employees and employer's contribution are remitted to NPS Trust Account regularly. NPS Accounts are maintained by NSDL. Hence separate schedule has not been prepared.

GPF is not applicable to the institute employees. Hence GPF accounts schedule has not been prepared.

Other Additions

As per the institute's policy, the overhead generated from the Externally Funded Projects have been segregated into four parts vis-a-vis, (i) 45% - income from overheads to institute, (ii) 5% - Staff Welfare Fund, (iii) 25% - School Promotion Fund and (iv) 25% - Personal Promotion Fund. The said figures (ii) to (iv) have been depicted as other additions in Schedule 1 of Annual Accounts including the Student Friendship Fund.

(B.V.Ramesh)
Deputy Registrar (F&A)

SEPARATE AUDIT REPORT OF THE COMPTROLLER & AUDITOR GENERAL OF INIDA ON THE ACCOUNTS OF INDIAN INSTITUTE OF SCIENCE EDUATION AND RESEARCH [IISER] THIRUVANANTHAPURAM FOR THE YEAR ENDED 31 MARCH 2021

1) We have audited the attached Balance Sheet of Indian Institute of Science Education and Research Thiruvananthapuram as at 31 March 2021, the Income & Expenditure Account and Receipts & Payment Account for the year ended on that date under Section 19(2) of the Comptroller and Auditor General's (Duties, Powers and Conditions of Service) Act, 1971 read with section 22(2) of the NITSER Act, 2007. These financial statements are the responsibility of the Institute's management. Our responsibility is to express an opinion on these financial statements based on our audit.

2) This Separate Audit Report contains the comments of the Comptroller & Auditor General of India (CAG) on the accounting treatment only with regard to classification, conformity with the best accounting practices, accounting standards and disclosure norms, etc. Audit observations on financial transactions with regard to compliance with the Law, Rules & Regulations (Propriety and Regularity) and efficiency-cum-performance aspects, etc., if any, are reported through Inspection Reports/CAG's Audit Report separately.

3) We have conducted our audit in accordance with auditing standards generally accepted in India. These standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatements. An audit includes examining, on a test basis, evidences supporting the amounts and disclosure in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of financial statements. We believe that out audit provides a reasonable basis for our opinion.

4) Based on our audit, we report that:

i) We have obtained all the information and explanations, which to the best of our knowledge and belief were necessary for the purpose of our audit;

ii) The Balance Sheet, Income & Expenditure Account and Receipt & Payment Account dealt with by this report have been drawn up in the format approved by the Ministry of Education, Government of India;

iii) In our opinion, proper books of accounts and other relevant records have been maintained by the Indian Institute of Science Education and Research Thiruvananthapuram as required under Regulation 16.1 forming part of Memorandum of Association of the Institute in so far as it appears from our examination of such books; and

iv) We further report that:

A. Grant-in Aid

Indian Institute of Science Education and Research Thiruvananthapuram has opening balance of unspent grant of Rs.158.90 crore and it received a grant-in-aid of Rs.60.50 crore from Ministry of Education, Government of India during 2020-21. Out of the total grant of Rs.219.40 crore, the IISERTVM utilized Rs.70.12 crore during the year, leaving a balance of Rs.149.28 crore as on 31.03.2021.

B. Management Letter

Deficiencies which have not been included in the Separate Audit Report have been brought to the attention of Institute through a Management Letter issued separately for remedial/corrective action

v) Subject to our observations in the preceding paragraphs, we report that the Balance sheet, Income & Expenditure Account and Receipt & Payment Account dealt with by this report are in agreement with the books of accounts.

vi) In our opinion and to the best of our information and according to the explanations given to us, the said financial statements read together with the Accounting Policies and Notes on Accounts, and subject to the significant matters stated above and other mattes mentioned in Annexure I to this Audit Report give a true and fair view in conformity with accounting principles generally accepted in India.

a) In so far as it relates to the Balance Sheet, of the state of affairs of the Indian Institute of Science Education and Research Thiruvananthapuram as at 31 March 2021; and

b) In so far as it relates to Income & Expenditure Account of the deficit for the year ended on that date.

For and on behalf of the C & AG of India

Sd/-
Principal Director of Audit (C), Chennai

Place:
Date:

Annexure I

1. Adequacy of Internal Audit System:-

The Internal Audit system is not adequate as there is no internal audit wing in the Institute. The internal audit is conducted by Chartered Accountants.

2. Adequacy of Internal Control System:

The Institute is following the generally accepted accounting practices and prepared its Annual Accounts in the format prescribed by Ministry of Education. The Institute is following the provisions of the GFR along with orders, instructions and guidelines issued by the Govt. of India from time to time. However, Institute is not maintaining records of consumables available in various Labs as the items issued to Labs are treated as consumed. This practice is not as per the format of accounts prescribed by MoE.

3. System of Physical Verification of Fixed Assets:

Physical Verification of Fixed assets has been conducted up to the year 2020-21.

4. System of Physical Verification of Inventories:

The Institute is not maintaining records of consumables available in various Labs. Hence there is no physical verification of inventories also. This practice is not as per the format of accounts prescribed by MoE.

5. Regularity in payment of statutory dues:

The Institute is regular in payment of statutory dues and no dues are pending.

Sd/-
Dy Director [DT] II

Indian Institute of Science Education and Research

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