INDIAN ACADEMY OF SCIENCES
Bengaluru 560 080

35th MID-YEAR MEETING

28 – 29 June 2024

**Venue: Auditorium, New Biological Sciences Building,
Indian Institute of Science, Bengaluru**

ABSTRACTS OF LECTURES

Friday 28 June 2024
09:30–10:10

Session 1A: Special Lecture
Chairperson: V Nagaraja, Indian Institute of Science, Bengaluru

Fat on the move

Molecular motors are nano-scale machines that transport bacteria, virus, mitochondria etc. inside living cells. The use of optical tweezers for measuring the tiny forces exerted by these motors has been at the forefront of single-molecule interdisciplinary research for decades. Unfortunately, such studies reveal very little about how these motors function inside an animal. How tiny fat bodies are moved around by motors inside liver cells and how this motion reflects in blood tests will be discussed. The speaker will also describe his group's attempts to control this motion for therapeutic benefits.

Speaker Profile

Roop Mallik is Professor of biosciences and bioengineering at Indian Institute of Technology, Mumbai. He received his PhD in 1999 from TIFR, Mumbai. He was a faculty member at the Department of Biological Sciences, Tata Institute of Fundamental Research, Colaba, Mumbai from 2006–2020. His research interests are intracellular transport, biophysics of lipids and motor proteins, pathogen degradation, metabolism and liver biology, lipid homeostasis. He was elected Fellow of the Indian Academy of Sciences in 2017 and was elected Fellow of INSA in 2022.

Roop Mallik
Indian Institute of Technology, Mumbai

Friday 28 June 2024
10:10–10:30

Session 1B: Inaugural Lectures by Fellows/Associates
Chairperson: Kalidas Sen, University of Hyderabad

Higher order transport equations: Why do we need them?

The Navier–Stokes equations are well-known fluid equations and have been employed for more than a century to describe flows. However, there is growing evidence in literature as well as from experimental data from labs suggesting that these equations are inadequate to explain several observations with low-pressure gas flows. There seems to be no satisfactory alternative to theoretically describe gas flow when the mean free path of the gas is of the order of the characteristic length scale. The two known approaches of solving the Boltzmann equation yield the Burnett and Grad 13-moments equations, which are higher-order transport equations. However, several shortcomings of these equations are known by now. This motivated the speaker's group to explore alternate ways to study and derive higher-order transport equations. A novel approach of employing a distribution function consistent with Onsager's reciprocity principle to capture non-equilibrium thermodynamics effects, and present the new equations derived by the speaker's group will be discussed. The attractive features of these newly derived OBurnett and O13 equations and some novel solutions of these equations will be highlighted. The talk will describe the conditions under which the celebrated Navier–Stokes equations fail, and the way to model fluid flow under such extreme circumstances.

Speaker Profile

Amit Agrawal is Professor of mechanical engineering at Indian Institute of Technology, Mumbai. He received his PhD in 2002 from University of Delaware. His research interests are turbulence, particle image velocimetry (PIV), heat transfer, rarefied gas flows, and microfluidics. He was elected Fellow of the Indian Academy of Sciences in 2021.

Amit Agrawal
Indian Institute of Technology
Bombay, Mumbai

Friday 28 June 2024
10:35–10:55

Misfolding and intrinsic disorder: When a protein fails to fold

Folding of proteins is crucial for executing cellular functions. Protein folding/misfolding relies on the concept of a rugged funnel-shaped energy landscape with the native state located at the global free energy minimum. The ruggedness in the energy landscape ensures that in addition to this global minimum, there are many local minima that correspond to partial/total misfolded states. Experimental techniques also confirm such a diverse conformational manifold under native conditions. There is equilibrium between the native state and several partially folded conformations which constitute the native state ensemble. Folding or refolding to such misfolded conformations may lead to a change in the functionality or off-pathway aggregation and causes a range of diseases or loss of protein functions. Intrinsically disordered proteins do not fold into well-defined native structures and exist in nature as a fluctuating ensemble of interconvertible conformations under standard physiological conditions. These functional proteins are aggregation-prone and are implicated in many neurodegenerative diseases and some forms of cancer. The speaker's group probed the underlying physical principles that govern misfolding and intrinsic disorder in proteins via theoretical and computational methods. The results provide insights into the effects of environment, sequence composition, mutations, hydration, structural flexibility, and foldability of these proteins.

Speaker Profile

Parbati Biswas is Professor at the Department of Chemistry, University of Delhi, Delhi. She received her PhD in 1996 from the Indian Institute of Science, Bengaluru. Her research interests are theoretical physical chemistry and theoretical chemical physics. She was elected Fellow of the Indian Academy of Sciences in 2023.

Parbati Biswas
University of Delhi, Delhi

Friday 28 June 2024:
11:20–11:40

Session 1C: Inaugural Lectures by Fellows/Associates
Chairperson: Swagata Dasgupta, IIT Kharagpur

The mighty mylonites of the Bundelkhand craton: Clues to the basement rock selection of medieval forts in the Bundelkhand region, India

Globally, igneous provinces always provided stable basements for the construction of a diversity of palaces, castles, monuments, mausoleums, religious places, epitaphs, etc. The Heritage Stone Subcommission, under the aegis of the International Union of Geological Sciences (IUGS), identifies heritage stone resources from various continents to designate a stone as a Global Heritage Stone Resource (GHSR) based on certain parameters such as texture, mineralogical composition, colour and strength of the rocks. The Bundelkhand region is home to ~40 medieval forts built by different dynasties of north central India, as identified by the Archaeological Survey of India. The aesthetics, availability and cultural and religious sentiments related to these rocks probably made the choice for these rocks for construction of these ancient structures. While most of these forts built during the medieval period were constructed using various rocks/stones, the basements of these forts are often recognized as deformed mylonitized granitoids, which differentiate them from the surrounding undeformed to mildly deformed granitoids and/or quartz reefs in the craton. A few such examples include the Garh Kundar Fort (~925 AD) and Karera Fort (~1300 AD) built along the Raksa shear zone, a crustal-scale shear zone in the Bundelkhand craton. Notably, our ancestors might not have had formal training for the determination of the strength of the rocks over which they built forts or raised high structures until the 17th century, but they surely possessed scientific aptitude.

Speaker Profile

Sayandeep Banerjee is Assistant Professor of geology, Banaras Hindu University, Varanasi. He received his PhD in 2016 from University of Calcutta. His research interests are structural geology, global tectonics, rheology of partially molten rocks, kinematics of rock deformation, crystallography and geomorphology. He was elected Associate of the Indian Academy of Sciences in 2023.

Sayandeep Banerjee
Banaras Hindu University
Varanasi

Friday 28 June 2024
11:45–12:05

Solving linear high order differential equations in nearly linear time

Standard divide-and-conquer methods are used to obtain nearly linear time algorithms for computing modular inverses of polynomials. How these methods can be extended to obtain similar nearly linear time algorithms for solving high-order differential equations will be explained. More precisely, given a (m+2)-variate polynomial $Q(x, y_0, \ldots, y_m) = A(x) + \sum_{i=0}^{m} B_i(x) \cdot y_i$

How to obtain all low-degree polynomials *f(x)* that satisfy the following differential equation will be shown: $Q\left(x, f(x), \frac{df}{dx}, \ldots, \frac{d^m f}{dx^m}\right) \equiv 0.$

Such differential equations arise naturally in several settings. How they help to obtain nearly linear time list-decoding algorithms for univariate multiplicity codes will be illustrated.

Speaker Profile

Prahladh Harsha is Professor at Tata Institute of Fundamental Research, Mumbai. He obtained his PhD under the supervision of Professor Madhu Sudan from Massachusetts Institute of Technology (MIT), and he completed his postdoctoral work at Microsoft Research-Silicon Valley, and was a research assistant professor at the Toyota Technological Institute at Chicago. He was elected Fellow of the Indian Academy of Sciences in 2024.

Prahladh Harsha
Tata Institute of Fundamental Research, Mumbai

Friday 28 June 2024
12:10–12:30

A minimal synthetic model of confluent epithelia

In assemblies of passive particles, increasing the packing fraction can drive the system to a glassy or jammed state. Epithelial cell monolayers, however, can jam, unjam, and reveal many aspects of glassy slowing down often seen in passive systems while remaining confluent, i.e., the packing fraction remains at unity. This remarkable feature of cell monolayers is made possible via changes in cell shape. Furthermore, recent experimental and theoretical studies suggest that cell shape fluctuations, discarded as experimental noise until now, correlate with dynamics. A recently developed synthetic model system that allows for independent control of activity, chiral activity, and cell deformability, helping the speaker and his group to directly confront theory and numerical predictions, will be described. The cell shape variability in synthetic system mimics that seen in living ones and its intimate connection to dynamical arrest will be demonstrated.

Speaker Profile

Rajesh Ganapathy is Professor in the International Centre for Materials Science and School of Advanced Materials, JNCASR, Bengaluru. Rajesh joined Professor Ajay Sood's group in the Department of Physics, Indian Institute of Science, Bengaluru for a Ph.D. (2000–2006). He joined JNCASR in 2009. His research interest is experimental soft condensed matter physics. He was elected Fellow of the Indian Academy of Sciences in 2024.

Rajesh Ganapathy
Jawaharlal Nehru Centre
for Advanced Scientific
Research, Bengaluru

Friday 28 June 2024
12:35–12:55

Iron-depleted diet enhances the lifespan of *Caenorhabditis elegans*

Aging is a multifaceted phenomenon characterized by progressive physiological deterioration and is associated with various disorders, such as cancer, diabetes, and neurodegenerative diseases. Recent studies have highlighted the significance of gut microbiota in influencing host health and lifespan. Additionally, host lipid metabolism appears to play a role in aging and age-related disorders. However, the role of the gut microbiota in regulating host lipid metabolism that can impact aging remains understudied. In their study, using host lipid metabolism as a proxy, the speaker and his group screened a genome-wide *Escherichia coli* mutant library and discovered 26 *E. coli* mutants that increase *Caenorhabditis elegans* lifespan. Transcriptomic analysis of worms fed on these *E. coli* mutants revealed an increase in oxidative stress response genes. We determined that *C. elegans* fed on these *E. coli* mutants exhibited increased activity of the mitochondrial unfolded protein response (mt-UPR). The increased mt-UPR and enhanced lifespan were due to reduced iron levels in the identified bacterial mutants. Supplementation with ferric chloride rescued the enhanced mt-UPR and abolished the lifespan extension of worms grown on these diets. Mechanistically, that lifespan enhancement on a low-iron diet is dependent on the HLH-30 and AMP kinase AAK-2 signaling pathways of the host, will be demonstrated.

Speaker Profile

Jogender Singh is Assistant Professor of biological sciences, Indian Institute of Science Education and Research, Mohali. He obtained his PhD in 2015 from the National Centre for Biological Sciences, Bengaluru. His research interests are cellular stress biology, innate immunity and *C. elegans* genetics. He was elected as an Associate of the Indian Academy of Sciences in 2023.

Jogender Singh
Indian Institute of Science Education and Research, Mohali

Friday 28 June 2024
14:30–16:30

Session 1D - Symposium on “Twistronics”

Speaker Profile

Manish Jain received his PhD in 2002 in materials science and engineering from the University of Minnesota. Since December 2012 he is a faculty member at the Department of Physics, Indian Institute of Science, Bengaluru. At IISc, he established the Quantum Theory of Materials group with graduate students, postdoctoral fellows and research assistants, with whom he conducts research on developing methods and understanding electronic, optical, structural and dynamical properties of materials. His research interests are in density functional theory, many-body perturbation theory, and twistronics. He was elected Fellow of the Indian Academy of Sciences in 2023.

Chairperson

Manish Jain
Indian Institute of Science
Bengaluru

Friday 28 June 2024
14:30-14:55

When and why do we have unconventional behaviour in van der Waals bilayers?

There has been a lot of recent interest in hetero structures of van der Waals materials, with the easy exfoliation of each layer allowing for novel structures to be constructed. In the hierarchy of interactions, the van der Waals' interactions are the weakest, so finding unconventional phenomena merely by changing small details of how these materials are stacked seems puzzling. A family of materials will be considered, and how rotating one layer with respect to the other leads to unconventional behaviour will be shown.

SpeakerProfile

Priya Mahadevan is Professor at the SN Bose National Centre for Basic Sciences, Kolkata. She completed her PhD from Indian Institute of Science in Bengaluru in 1998. Her research interests range from understanding and predicting magnetism, complex ordering phenomena of correlated electrons manifesting as charge and orbital ordering, size-dependent elastic properties in semiconductors, structure evolution at the nanoscale, etc. She was elected Fellow of the Indian Academy of Sciences in 2014.

Priya Mahadevan
SN Bose National Centre for Basic Sciences, Kolkata

Friday 28 June 2024
15:00–15:25

Moiré fractals in twistronics

The field of twistronics and Moiré patterns will be introduced. A broad theoretical framework by considering the behaviour of charge carriers in an effective super-lattice potential to understand the single-particle physics in a host of van der Waals hetero-structures (a common acronym for layered materials) which is a frontier research area in electronic materials will be explained (more popularly dubbed as "quantum materials" in modern day literature). The basic physics of Moiré patterns in twisted bilayer graphene will be explained in this framework. Subsequently the recently introduced concept of "Moiré fractals" that provides quantitative information about band structures of large class of super-Moiré systems that consists of two or more Moiré structures under certain specific conditions will be described. How such structures can be observed in experiments will also be explained.

SpeakerProfile

Sankalpa Ghosh is Assistant Professor at the Indian Institute of Technology, Delhi. He completed his PhD from Jawaharlal Nehru University, Delhi. His research interests are quantum hall systems, ultra-cold atoms and Bose–Einstein condensation, and electron transport in Dirac materials (graphene, topological Insulators etc).

Sankalpa Ghosh
Indian Institute of Technology, Delhi

Friday 28 June 2024
15:30–15:55

Graphene on hBN: Bands with a twist

The relationship between energy (E) and wave vector (k, the inverse of wavelength) is a key characteristic of quantum systems. In metals, the energy of electrons varies quadratically with k, whereas for photons, the relationship between E and k is linear. This means that electrons in metals are non-relativistic, while photons adhere to Einstein's theory of relativity. Graphene presents a condensed matter system that allows the study of relativistic effects in a laboratory setting. In this talk, how the dispersion relation in bilayer graphene can be transformed from non-relativistic to relativistic by creating Moiré superlattices will be explained. This is done by placing graphene on an insulator, boron nitride (hBN), which has a slight lattice mismatch with graphene. The effect is further enhanced by introducing a small twist between the graphene and the hBN lattice. How this alteration in the electronic dispersion relation of graphene influences its electronic properties will be discussed.

Speaker Profile

Aveek Bid is an Associate Professor at the Indian Institute of Science, Bengaluru. He completed his PhD from the Department of Physics, Indian Institute of Science. His research interests are electrical transport in two-dimensional materials, graphene, and low-dimensional superconductors.

Aveek Bid
Indian Institute of Science
Bengaluru

Friday 28 June 2024
16:00–16:25

Twisted bilayer graphene–A magic platform

The recent discovery of twisted bilayer graphene with flat bands has led to many unprecedented emerging phenomena in the condensed matter of physics. In this presentation, an overview of the field of twisted bilayer graphene and its significance in the current scientific landscape will be provided, and recent experiments exploring emergent properties of these systems will be discussed.

Speaker Profile

Anindya Das is Associate Professor at the Indian Institute of Science, Bengaluru. His research interest are transport properties of mesoscopic structures in reduced dimensions: one-dimensional carbon nanotube (CNT), semiconductor nanowires; zero-dimensional quantum dots; two-dimensional graphene, 2D and 3D topological insulators.

Anindya Das
Indian Institute of
Science, Bengaluru

Friday 28 June 2024
18:00–19:00

Session 1E : Public Lecture
Chairperson: Umesh Wagahmare, President, Indian Academy of Sciences, Bengaluru

The many layers of Indian prehistory: From research to public outreach

The complex and multilayered story of the earliest prehistoric occupation of South Asia has generated vigorous debates on cultural evolution, population migration, and adaptation to past climatic changes. Here, the earliest processes of cultural evolution in South Asia beginning in the lower Palaeolithic, more than a million years ago, and culminating with the transition to agro-pastoral modes of life in the 'Neolithic' will be discussed. These processes are situated within the context of past environmental changes and debates on population migrations out of Africa. The evolution of conceptual approaches and nomenclatures in Indian prehistory, with implications for ways in which the past is interpreted will be highlighted. These issues are situated in the context of our long-term research in Tamil Nadu, with a focus on the sites of Attirampakkam, Sendrayanpalayam, and others. Prehistoric sites in India are rapidly vanishing under the onslaught of infrastructure development and lack of awareness of what these sites comprise. The urgent need for awareness creation and conservation to protect this heritage for the future and present sustainable plans for achieving the same will be discussed.

Speaker Profile

Shanti Pappu is the Founder/Secretary of the Sharma Centre for Heritage Education (SCHE; established 1999), India, an Institute committed to both research in archaeology and public outreach. She specializes in prehistoric archaeology, beginning with cultures marking the earliest Palaeolithic occupation of India (beginning around 1.5 million years ago) and extending up to periods marked by transitions to Neolithic agro-pastoral communities. Her interests lie in

Shanti Pappu
Founder/Secretary,
Sharma Centre for
Heritage Education India,
Chennai

prehistory and quaternary studies, history of archaeology, ethnoarchaeology, and experimental archaeology and museology. She obtained her PhD from the Deccan College, Pune, India. She has over 20 years of experience in prehistoric archaeology. She strongly believes that research, especially a less well-known field like prehistory, must be complemented by public awareness and outreach. Along with Dr. Kumar Akhilesh, she is responsible for developing the public archaeology and outreach programs at the SCHE and in developing the children's museum. Through in-house and outreach programs and travelling workshops, the team addresses school children and teachers, university students and faculty and interested local communities on aspects of archaeology. Workshops for children and teachers are conducted in English and several Indian languages, and comprise innovative teaching methods to bring alive the past. The Centre's public outreach programs seek to create an interest in Indian archaeology, that serves as a foundation for devising sustainable goals for heritage education, management and conservation.

Saturday 29 June 2024
09:30–10:10

Session 2A: Special Lecture
Chairperson: Kalyan Bidhan Sinha, JNCASR, Bengaluru

Differential Equations:A glimpse

Differential equations, ordinary as well as partial, arise in many applications and their study is being pursued vigorously using a variety of tools. From an analyst's view point, the main issues of different types of solutions and their existence, uniqueness and also certain control aspects will be discussed.

Speaker Profile

Mythily Ramaswamy is Senior Scientist in mathematics at the International Centre for Theoretical Sciences-TIFR, Bengaluru. She completed her PhD in 1990 at Paris. She was faculty at the TIFR Centre for Applicable Mathematics, Bengaluru (until retirement in 2019). She is Adjunct Professor at Chennai Mathematical Institute since 2019. She was elected Fellow of the Indian Academy of Sciences in 2007 and NASI Senior Scientist. Her research interests lie in analysis of differential equations and applications to control problems. At presently, she serves on the Council of the Indian Academy of Sciences.

Mythily Ramaswamy
International Centre for Theoretical Sciences-TIFR, Bengaluru

Saturday 29 June 2024
10:10–10:35

Session 2B: Inaugural Lectures by Fellows/Associates
Chairperson: Anil K Gupta, IIT Kharagpur

Spin texture driven magnetization dynamics in engineered magnetic nanostructures

Engineered magnetic nanostructures will form important building blocks for next-generation spintronics and externally controlled spin textures offer new opportunities for novel spin-based device fabrication. The optimization of these devices demands understanding and control of ultrafast spin dynamics as well as spin-wave propagation. Here, femtosecond laser-induced ultrafast magnetization dynamics controlled by domain-wall origami in a $[Co/Pt]_{22}$multilayer will be discussed. Depending on the underlying domain landscape, the spin-transport-driven magnetization dynamics show a transition from ultrafast demagnetization to an anomalous transient magnetization enhancement (TME) via a state where both TME and demagnetization coexist in the system. Thereby, the study revealed an extrinsic channel for the modulation of spin transport, which will introduce a route for the development of magnetic spin-texture-driven ultrafast spintronics devices. Furthermore, the development of on-demand magnonic nanochannels by periodically tailoring perpendicular magnetic anisotropy using an electric field will be discussed. Brillouin light scattering measurement revealed magnonic bands, consisting of two spin-wave frequency modes, along with a bandgap under the application of moderate gate voltage, which can be switched off by withdrawing the voltage. The anticrossing between these two modes gives rise to the observed magnonic bandgap. This study will lead to on-chip parallel data communication and processing.

Speaker Profile

Anjan Barman is Senior Professor at the Department of Condensed Matter and Materials Physics at SN Bose National Centre for Basic Sciences, Kolkata. He completed his PhD in 1999 at IACS, Jadavpur University. His research interests are nanomagnetism and spintronics. He was elected Fellow of the Indian Academy of Sciences in 2020.

Anjan Barman
SN Bose National Centre for Basic Sciences, Kolkata

Saturday 29 June 2024
10:35–10:55

Laser communication through turbulent and turbid atmosphere

Optical wireless communication, commonly known as Free-Space Optical (FSO) communication, is an emerging technology which facilitates unprecedented channel capacity and large bandwidth, favouring huge volume of data transfer across distant locations. Scintillation and beam wander resulting from optical phase distortions, along with absorption and scattering in the atmospheric channels, can adversely affect the performance of FSO links. This lecture will provide a brief introduction to the effects of atmospheric aerosols (tiny solid/liquid particles suspended in the atmosphere) and refractive index fluctuations on optical propagation through turbulent and turbid atmosphere. Synergized analysis of data from surface, atmospheric boundary layer, balloon, and multi-satellite observations, along with radiative transfer calculations, is used to discuss the combined role of lower atmospheric turbulence and aerosols on FSO communication. The need for region-specific atmospheric optical turbulence models and long-term meteorological observations in improving the efficiency of FSO communication links will be highlighted.

Speaker Profile

Anand N Sarma is Assistant Professor at School of Earth, Environmental and Sustainability Sciences, IISER Thiruvananthapuram. He completed his PhD in 2020 at the Indian Institute of Science, Bengaluru. His research interests are atmospheric optics, aerosols, atmospheric boundary layer, optical turbulence, and free-space optical communication. He was elected as Associate of the Indian Academy of Sciences in 2023.

Anand N Sarma
Indian Institute of Science Education and Research, Tiruvananthapuram

Saturday 29 June 2024
11:20–11:40

Session 2C: Inaugural Lectures by Fellows/Associates
Chairperson: Naba Kumar Mondal, Saha Institute of Nuclear Physics, Kolkata

Understanding and solving an ancient disease through modern approaches

Tuberculosis (TB) is an ancient disease caused by *Mycobacterium tuberculosis (Mtb)*, an intracellular pathogen. TB control remains a challenge due to a lack of an effective vaccine and long treatment duration. In addition, the rapid emergence of drug-resistant (both multi- and extensively drug-resistant) TB has added layers of complexity to TB control programs. The speaker and his team have been trying to understand host responses to *Mtb* infections with an overarching goal of developing host-directed approaches for the prevention and control of tuberculosis. The host response to *Mtb* infection at molecular, cellular and tissue organization levels have been characterized. Thus, at the molecular level, how *Mtb* alters host transcriptional and post-transcriptional regulatory responses and intracellular trafficking have been explored. At the cellular and tissue level, the role of diverse cellular and sub-cellular niches has been explored. Their efforts have yielded unprecedented insights into how Mtb alters host responses to its own advantage. Moreover, they have also been able to unravel immunological correlates of protection. Overall, their results have the potential to develop novel host-directed adjunct therapies for the prevention and control of TB.

Speaker Profile

Dhiraj Kumar is group leader in Cellular Immunology, at the International Centre for Genetic Engineering and Biotechnology (ICGEB), New Delhi. He completed his PhD in 2007 at ICGEB. His research interests are phagocyte cell biology, innate immune responses to *Mycobacterium tuberculosis* or HIV infections, high-throughput biology and computational biology. He was elected Fellow of the Indian Academy of Sciences in 2024.

Dhiraj Kumar
International Centre for Genetic Engineering and Biotechnology,
New Delhi

Saturday 29 June 2024
11:45–12:05

Experimental cosmology at radio frequencies

There remain some open problems in Lambda-CDM cosmology. The speaker will explain various foregrounds to cosmological observations focusing on a few of these, and discuss some experimental activities pertaining to the Array of Precision Spectrometers for the Epoch of RecombinAtion – APSERa – an upcoming cosmology experiment at radio frequencies to study the formation of the first atoms over the epoch of recombination.

Speaker Profile

Mayuri Rao is Associate Professor at the Raman Research Institute (RRI), Bangalore. She completed her PhD in 2017 from the Research School of Astronomy and Astrophysics of the Australian National University (ANU). Her research interests include building instruments and techniques to detect faint distortions in the spectrum of the cosmic microwave background radiation. She is also interested in foreground modeling and subtraction as applicable in low, mid-frequency radio astronomy, with a special interest in the diffuse radio emission from our galaxy. She was elected as Associate of the Indian Academy of Sciences in 2023.

Mayuri Rao
Raman Research Institute,
Bengaluru

Saturday 29 June 2024
12:10–12:30

SKIP "JAZ" by SKIP31: A key event for seed maturation and desiccation tolerance

Seed desiccation tolerance is one of the remarkable adaptive traits in flowering plants, which played a decisive role in the evolution and colonization of land plants. These features allow seeds to extend their viability and germinability while remaining in a desiccated state for long periods of time. To achieve this feat, seeds engage multi-layered regulatory networks that activate many genes involved in various mechanisms that ultimately improve seed survival and vigor upon maturity. Among these networks, the phytohormone abscisic acid (ABA) and ABA-responsive master regulators play a key role in modulating seed maturation. In general, ABA signalling is essentially activated during seed maturation and onset of seed dormancy, while repressed during seed germination. However, how seeds attain differential ABA signalling during phase transition from seed maturation to germination events remains obscure. A recent study reveals a new module (AtSKIP31-JAZ-ABI5) in regulating seed maturation, desiccation tolerance and consequent seed vigor in Arabidopsis. The F-box protein AtSKIP31, which is upregulated during late seed maturation, targets JAZ proteins in JA/Ile in an independent manner for proteasomal degradation that releases the inhibitory effect of JAZ proteins on ABI5 and activates downstream signalling, that is important for seed maturation and consequent seed vigor.

Speaker Profile

Manoj Majee is Staff Scientist VI at the National Institute of Plant Genome Research, New Delhi. He completed his PhD at Bose Institute/Jadavpur University. His research interests are plant stress and seed biology/ plant molecular biology and biochemistry. He was elected Fellow of the National Academy of Sciences in 2019 and Fellow of the Indian Academy of Sciences in 2022.

Manoj Majee
National Institute of Plant Genome Research,
New Delhi

Saturday 29 June 2024:
12:35–12:55

Amorphous carbon thin film: An emerging electronic material

The excellent mechanical properties of monolayer amorphous carbon (a-C) thin films (an analog of graphene) with high deformation tolerance are expected to be useful for flexible electronics. The fabrication of high-performance wafer-scale electronic devices both on flexible and solid substrates, exploiting the excellent properties of a-C thin films will be discussed. The speaker will describe the unprecedented anisotropic conductivity of their synthesized amorphous carbon (a-C) thin films and an unconventional conversion concept of transforming a rigid metal circuit into a foldable circuit. Since the synthesized a-C thin film has electrical transparency only in the vertical direction (anisotropic conductivity), the metal/a-C hybrid board reflects the complexity of the underlying metal circuit board. The a-C thin film electrically connects the cracked area of the metal line; thus, the hybrid circuit board is foldable without resistance change during repeated folding cycles. Then, the speaker will also discuss the remarkable performance of a-C thin films as an interfacial layer between gate dielectric and semiconductors in a thin film transistor device, where the interfacial a-C thin film reduces the interfacial trap state densities and increases the electronic mobility 7 times and On/Off ratio three-fold. A foldable perovskite light-emitting diode (PeLED) and a biaxially-stretchable alternating current electroluminescence (ACEL) display will also be discussed, which were fabricated using highly conductive transparent deformable Au film electrodes, synthesized utilizing a-C thin films. Finally, the speaker will discuss the fabrication of a highly flexible pixelated ACEL display by a highly conducting pyrolyzed carbon (Py-C) ultrathin film synthesized from a-C thin films directly on various target substrates.

Speaker Profile

Monalisa Pal is Assistant Professor at the Institute of Science, Banaras Hindu University, Varanasi. She completed her PhD in 2016 at the SN Bose National Centre for Basic Sciences, University of Calcutta. Her research interests are synthesis of organic and inorganic semiconductors, synthesis of multifunctional fluorescent probes for sensing, photodetectors and biomedical applications. She was elected Associate of the Indian Academy of Sciences in 2023.

Monalisa Pal
Institute of Science,
Banaras Hindu University,
Varanasi

ABSTRACTS OF LECTURES

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Venue: Auditorium,
New Biological Sciences Building,
Indian Institute of Science, Bengaluru