Sectional Committee -II

Physics

Chair
Prof. Tanushree Saha Dasgupta, FNA

Works in area of computational materials physics. Fellow of American Physical Society, The word academy of sciences, Indian National Science Academy, Indian Academy of Sciences, National Academy of Sciences, India and West Bengal Academy of Sciences. Currently Senior Professor and Director at S. N. Bose Centre.

Scientific Innovation in the Godrej Industries Group

Nadir Godrej

Chairman and MD Godrej Industries
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A detailed discussion on various research initiatives, over the years, that helped the group grow steadily and contribute to humanity. Research in animal feeds, agrochemicals, oleochemicals and specialty chemicals are discussed. The importance of Green Chemistry and environmental sustainability is discussed.

Speaker's Profile

Nadir Godrej is the Chairperson of Godrej Industries Group and the Chairperson and Managing Director of Godrej Industries. He received a B. S. degree in Chemical Engineering in 1973 from the Massachusetts Institute of Technology, and an M.S. in Chemical Engineering in 1974 from Stanford University. He also earned an MBA from Harvard Business School in 1976. Since 1977, he has served as a Director of Godrej Soaps Limited and has played a critical role in developing the animal feed, agricultural inputs, and chemicals businesses of Godrej Industries Group. He has also been very active in research and holds several patents in the field of agricultural chemicals and surfactants. In 2001, Godrej Soaps Limited was renamed Godrej Industries, and he was appointed Managing Director. He is also the Chairperson of Godrej Agrovet and a Director of Godrej Properties, both subsidiaries of Godrej Industries Group. Additionally, he serves on the boards of Godrej Consumer Products, Astec Life Sciences Limited and other group companies.

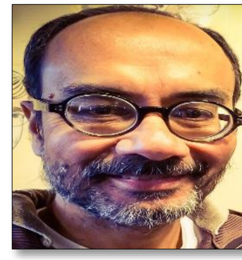
He has been actively engaged in various industry associations, including CLFMA (Compound Livestock Feed Manufacturers Association of India), ICC (Indian Chemical Council) [erstwhile ICMA (Indian Chemical Manufacturers Association)], and OTAI (Oil Technologists' Association of India). He also engages closely with the Harvard Business School and MIT Alumni Associations in India. He currently serves as the President of the Alliance Française de Bombay, and is a Member of the CII (Confederation of Indian Industry) National Council, having previously chaired the CII National Committee on Chemicals.

Mr. Godrej has been honored with numerous prestigious awards in India and internationally for his exceptional contributions to business, sustainability, and society. Recently, he was awarded an Honoris Causa degree by Bennett University, Times Group, and earlier this year received the Vivekananda International Relations Peace Award. In February 2025, he was honoured with the D.Sc. (Honoris Causa) from Institute of Chemical Technology. In 2023, he was recognized with the Hurun Award for Most Respected Indian Industrialist of the Year and the Game Changer Felicitation at the India Gulf Business Summit for redefining sustainability in business. He has also been conferred honorary doctorates by XIM University, Bhubaneswar, acknowledging his impact on industry and society.

His accolades include the Chevalier de Légion d'Honneur, Lifetime Achievement Awards from CLFMA of India, Indian Chemical Council, AILBIEA, and the Society Achievers "Pride of India Honour" for his contributions to entrepreneurship, sustainability, and philanthropy. Other notable recognitions include the Green Business Titan Award by JSW & The Times of India, the King Husein Global Business & Intercultural Peace Award, and the Qimpro Platinum Standard in Business Medal.

Mr. Godrej's illustrious career continues to inspire through his unwavering commitment to sustainability, business excellence, and societal progress. Science, linguistics, swimming and poetry; author of "Life and Other Poems" & "Nadir Godrej The Poet", a collection of English and French poems. Mr Godrej is known to make speeches in verse!

INSA Distinguished Lecture



Uniqueness of string theory

Ashoke Sen

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String theory has many manifestations that differ in the number of compact dimensions as well as the shapes and sizes of these compact dimensions. I shall discuss in what sense these different manifestations should be regarded as part of the same theory.

Speaker's Profile

Ashoke Sen is renowned for his pioneering contributions to string theory and quantum field theory. Born in 1956, he is a professor at the International Centre for Theoretical Sciences in Bengaluru, India. Sen's major achievements include: Foundational work on S-duality and strong–weak coupling dualities in string theory. The discovery of Sen's conjectures on tachyon condensation, which advanced understanding of unstable D-branes. Contributions to black hole entropy calculations and string field theory. He has received numerous honors, including the Breakthough Prize in Fundamental Physics (2012), Padma Bhushan (2013) and Dirac Medal (2014).

INSA Distinguished Lecture

A journey from raw material to nuclear radiation detector based on single crystal scintillators

Mohit Tyagi

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Although, Roentgen got the Nobel Prize for first finding of radiation about 120 years ago, but the crucial element of this pivotal discovery was the observation of glow on fluorescent screen. Since then, the application of scintillating materials is continuously increasing in medical and nuclear industry, basic research, homeland security etc. This ongoing increment in demands has need of the finding of novel scintillating crystals having required and improved performance characteristics. Further, the advancement in material synthesis and purity refinement techniques along with the state of art sensors and data acquisition systems have provided another dimension in this field. However, the discovery of alternative crystals and the improvement of existing scintillators' performances require a systematic and integrated multi-disciplinary approach. It can be achieved only when the researchers, experts in diverse fields, work altogether along with the end-users of the devices. In this talk, along with the general view of selecting an appropriate scintillator for a particular application and a systematic approach for adequately addressing various issues in the development of advanced scintillators will be presented with a few examples. The current interest in finding promising scintillators for neutron detection and pulse shape discrimination will be also discussed. The scintillation mechanism, which has gained interest in the last decade only, to address some unresolved issues and a few current and less explored problems would be also presented.

Speaker's Profile

Dr. Mohit Tyagi joined Crystal Technology Section, Bhabha Atomic Research Centre in 2005. He completed his M.Sc. Physics from CCS University Meerut and Ph.D. from HBNI, Mumbai and Post-Doc from University of Tennessee, USA. He visited Kyungpook National University in 2019 as a Brainpool fellow. He is working on the growth and characterization of single crystal scintillators for nuclear radiation detection. Along with the responsibility of developing nuclear radiation detector, He is member secretary of Basic Science committee of Board of Research in Nuclear Sciences. He is a recipient of the highest award of the Department of Atomic Energy (DAE) Homi Bhabha Manpatra-2024. His work has been recognised by various other awards including 'DAE Group Achievement- 2013', 'DAE Young Applied Scientist -2014', 'IACG Young Crystal Grower-2015', 'Nucleonix best researcher -2015', 'Indian Physical Society Young Physicist-2016' , DAE SSPS Young Achiever Award 2017, 'NASI Young Scientist -2017' , DAE Scientific & Technical Excellence Award 2020, INSA- Distinguished lecture 2025 etc." He is Young Associate of Maharashtra Science Academy and Member of Indian Young Academy of Science (INYAS-INSA) and National Academy of science (NASI)".

INSA New Foreign Fellow Lecture

Physics and Chemistry of Materials for Energy Storage Applications

B.V.R. Chowdari[1,2,3]

[1]Materials Research Society of Singapore, [2]National University of Singapore,[3] Nanyang Technological University Singapore
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The interdisciplinary nature of materials science with focus on the role of physics and chemistry for potential applications to global challenges is presented. The work done in my research group on Lithium-ion Batteries for Energy Storage applications is used as an example. The strategy adopted for improving the performance of the Lithium-ion Batteries through extensive research on synthesis, characterization, and optimization of novel electrode materials is highlighted with specific examples.

Speaker's Profile

Prof. B.V.R. Chowdari is a Materials Scientist. His research focuses on Lithium-ion Batteries for Energy Storage devices. He received Ph.D. degree from IIT Kanpur; Doctor of Literature (Honoris Causa) from Mangalore University, and Doctor of Science (Honoris Causa) from K.L. University. He served as the President of International Union of Materials Research Societies and Director of India-Connect Program at NUS and NTU. Currently, he is a Foreign Fellow of the NASI, Fellow of the SNAS, Vice-President of APAM, Member of the Executive Board of the AASSA, and President Emeritus & Senior Executive Director of Materials Research Society of Singapore.

Tailoring structure and properties of metastable alloys

J. H. Eckert [1,2]

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Metastable metallic alloys with hierarchical microstructure and combination of different phases can yield unique properties rendering them attractive for a variety of structural and functional applications. Such heterogeneous microstructures can combine the properties of their constitutive phases and allow property optimization through precise control of volume fractions and length-scale of the respective phases.

With respect to structural applications, one major goal is to achieve favourable combinations of high strength, good ductility and toughness by preventing shear localization. For this purpose, concepts of creating heterogeneous materials with different type and length-scale of phases have been followed to control the mechanical properties by proper alloy and microstructure design. Similarly, hybrid hierarchical microstructures can also generate new materials with improved performance.

Recent developments along this line will be outlined for different types of metallic alloys to illustrate how structural and functional properties can be tuned by appropriate phase and microstructure control. The resulting structures will be described for selected materials, and the mechanisms responsible for their mechanical behaviour will be discussed. Consideration of the challenges for the use of amorphous / nanostructured materials in engineering applications, as well as a discussion of the possible solutions, will also be addressed.

Speaker's Profile

Jürgen Eckert is Director of the Erich Schmid Institute (ESI) of Materials Science of the Austrian Academy of Sciences and Chair Professor of Materials Physics at Technical University of Leoben, Austria. His main research interests are materials physics, metastable materials as well as design and synthesis of advanced high performance nanostructured materials for structural and functional applications. He is author of more than 1400 scientific papers and holds 24 patents in the areas of materials science and processing technology. He received numerous honors and awards, and is a member of several Scientific Academies.

INSA New Foreign Fellow Lecture

Race to Develop Particle Accelerators for Particle physics in the 21st Century

Chandrashekhar J. Joshi

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High Energy particle accelerators have been the principal instrument of discovery of subatomic particles in the 20th century. This trend will likely continue if higher and higher center of mass energy lepton/hadron colliders can be built at a lower cost per GeV addition of energy. The capital cost of the collider is reduced by increasing the accelerating gradient whereas the operating cost is reduced by improving their wall plug efficiency. For the past 4 decades we have been working on a plasma-based linear accelerator that simultaneously increases the accelerating gradient and efficiency by more than 3 orders of magnitudes compared with the current radio frequency linear machines. We power our plasma accelerator by using high current, ultra-relativistic particle beams or ultra-short, PW-class laser pulses rather than RF as in conventional accelerators. When such tightly focused drive beams propagate through a column of ionized gas (plasma), they excite a disturbance that is nothing more than a space charge density wave that has electric field components that are both accelerating (longitudinal) and focusing (transverse). Unfortunately, the wakes are mesoscopic (sub mm diameter and m long) and transient (lifetime of tens of picoseconds). Nonetheless, ingenious schemes have been developed to inject and accelerate charge using such wakes and extract a significant fraction of the energy from the wake. Our latest results will be described.

Speaker's Profile

Professor Chan Joshi (UCLA) is a distinguished professor and holds the Mukund Padmanabhan Endowed Chair in Research Excellence . He is the founder of the experimental field of Plasma-based accelerators. He has received the Maxwell prize of the APS Alfven prize of the EPS and Marie Curie prize of the IEEE. In 2014 he was elected to the National Academy of Engineering.

Magnetic Texture Controlled Ultrafast Spin Dynamics in Engineered Magnetic Nanostructures

Anjan Barman

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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 [1]. The optimization of these devices demands understanding and control of ultrafast spin dynamics as well as spin-wave propagation. Here, we will discuss femtosecond laser-induced ultrafast magnetization dynamics controlled by domain-wall origami in $[Co/Pt]_{22}$ multilayer. Depending on the underlying domain landscape, the spin-transport-driven magnetization dynamics shows a transition from ultrafast demagnetization to an anomalous transient magnetization enhancement (TME) via a state where both TME and demagnetization coexist in the system [2]. Thereby, the study reveals 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, we will discuss the development of on-demand magnonic nanochannels by periodically tailoring perpendicular magnetic anisotropy using an electric field. 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 [3]. This study will lead to on-chip parallel data communication and processing.

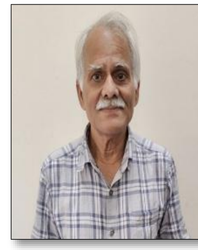
1. B. Pfau et al., Nat. Commun. **3**, 1100 (2012).
2. A. K. Mondal et al. ACS Nano **18**, 16914 (2024).
3. S. Choudhury et al. Sci. Adv. **6**, eaba5457 (2020).

Speaker's Profile

Professor Anjan Barman, Senior Professor at the S. N. Bose National Centre for Basic Sciences, received his Ph.D. from IACS, Jadavpur University in 1999. He held postdoctoral positions in Israel, the UK and the USA, and served as faculty at the University of South Carolina and IIT Delhi. A world leader in ultrafast spin dynamics, magnonics and spintronics, he pioneered all-optical spin control, spin-waves, hybrid and quantum magnonics, spin-orbitronics and strain-controlled magneto-elastic devices. He has published around 280 articles/books, supervised about 100 researchers, including 35 Ph.D. students and is a Fellow of IASc and IOP (UK).

INSA New Fellow Lecture

Wave-particle duality in double slit experiment and beyond



P.K. Panigrahi

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Starting from Thomas Young the double slit experiment has played a key role in establishing the wave nature of light. In quantum theory, understanding of wave particle duality and the collapse of the wave function during measurement process have been illustrated through the double slit experiment. Coherence of light lies characterizes the interference phenomenon measured through visibility as is well known detecting the light trajectory in a given slit leads to vanishing of the interference pattern yielding which path information and therefore the particle nature of light. Investigation of general multi slit scenario leads to an exact triality condition involving wave-particle nature and entanglement. We illustrate a surprising manifestation of entanglement and recent experimental investigation demonstrating this exact triality condition.

Speaker's Profile

Prof. Prasanta K. Panigrahi is presently director of Center for Quantum Science and Technology (CQST), SOA university and emeritus professor at IISER Kolkata. He has served as a faculty at University of Hyderabad, Physical Research Laboratory and at IISER Kolkata. He did his doctoral degree at university of Rochester in theoretical physics with postdoctoral experiences from University of Illinois and University of Montreal. His research interest lies in quantum information, quantum computing, nonlinear dynamics, many-body physics and data analysis. He is a fellow of National Academy of Science, India and Gujrat Science Academy.

Observing Symmetry and its Transitions with Trapped Ion Clusters

S. A. Rangwala

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Trapped ions, when laser cooled, crystalize in their minimum configuration, which combines the effect of external trap potential and their ion-ion interactions. They change morphologies when the trap potential is altered, which express as change in the structure of the cluster. The intriguing thing is that the ions are well separated and so can be imaged using a camera. The unit cell size of the clusters also permit very accurate computation of their structures which show near perfect agreement with the experiment. In this talk I will show images of the various structures of the clusters, as the potential imposed by the end cap ion trap is deformed. The transition of clusters from one configuration to another can be imaged and the structural transitions in these unit cell objects can be measured and quantified. Both displacive and reconstructive transitions are observed, the order parameter for the transitions can be rigorously arrived at and astonishingly, even a triple point is observed [1].

References

[1] Akhil Ayyadevara, Anand Prakash, Shovan Dutta, Arun Paramekanti, S. A. Rangwala, arXiv:2505.16378v3 [physics.atom-ph] https://doi.org/10.48550/arXiv.2505.16378

Speaker's Profile

Sadiq Rangwala, an experimental atomic, molecular and optical physicist, is presently a professor at the Raman Research Institute (RRI), Bangalore. He works with ultracold and trapped atoms, ions, molecules and studies interactions between them, using precision laser systems and quantum optics techniques. Atom-cavity QED studies are an important part of his scientific palette. He has received the Shanti Swarup Bhatnagar Award in Physics, the IPA P.K. Iyengar Award for Experimental Physics and is fellow of the Indian Academy of Sciences.

INSA New Fellow Lecture

Nuclear Physics towards the limit of stability

Aradhana Shrivastava

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Nuclear physics seeks to understand the fundamental nature of strongly interacting matter and the mechanisms that govern nuclear reactions from the earliest stages of the universe to present-day stellar environments. Much of our current understanding of nuclear structure and reactions arises from studies of low-energy interactions using particle beams produced by heavy ion accelerators. Recent advances in accelerator technology, coupled with state-of-the-art detection systems and data analysis techniques, have enabled the exploration of novel reaction mechanisms and exotic nuclear structures across a wide range of nuclei—both near and far from the line of stability.
This talk will highlight recent progress and emerging excitement in the field, with particular emphasis on nuclear fusion–fission processes involving both stable and weakly bound nuclei at energies deep below the Coulomb barrier. These studies, conducted using innovative experimental approaches, provide a sensitive testing ground for understanding quantum tunneling, coupling of collective excitations, and breakup effects that strongly influence barrier penetration probabilities. The results also have important implications for modelling astrophysical reaction rates that govern the synthesis of light and medium-mass elements in stellar and explosive environments.
In addition, the talk will outline future research directions and upcoming accelerator facilities in India aimed at advancing front-line studies in nuclear physics.

Speaker's Profile

Dr. Shrivastava is currently serving as Head, Nuclear Physics Division, BARC and Senior Professor of HBNI. She is recipient Homi Bhabha Science & Technology award, DAE Scientific & Technical Excellence Award and DAE Group Achievement Award. She has served as General Secretary of Indian Physics Association. She served as a member of the drafting group for Mega-Science Vision 2035 document, written on initiative by the Office of the Principal Scientific Advisor to the Government of India. She is Member of the Standing Advisory Group on Nuclear Applications of IAEA. Member of Technical program committee for the Physical Sciences of ANRF, for Advanced Research Grant. She is Fellow of the National Academy of Sciences, India.

The quantum life of pi

Aninda Sinha
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I will present an infinite number of new formulas for pi that originated from considerations in quantum field theory and string theory. This line of research was motivated by re-examining the historical origins of string theory, but rooted in modern understanding of quantum field theory. The hope is to generalize the string framework in an attempt to bootstrap it to nature. The resulting series for pi includes in a limit, the famous Madhava series. I will conclude my talk by discussing the famous Ramanujan 1/pi series and their connection with physics.

Speaker's Profile

Aninda Sinha is a theoretical physicist at the Centre for High Energy Physics, IISc, Bangalore and a Quantum Horizons Alberta senior fellow at the University of Calgary, Canada. His research interest is in quantum field theory, string theory, cosmology and quantum computing. He was awarded the 2015 Swarnajayanti fellowship, 2016 ICTP Prize, 2019 Shanti Swarup Bhatnagar Prize, 2024 Indian Academy of Sciences Fellowship, 2025 Wolfram Innovator Award and 2026 INSA fellowship.

INSA Associate Fellow Lecture

Probing electromagnetic fields in high-energy heavy-ion collisions through heavy quarks

Santosh K. Das
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One of the primary objectives of experiments at the Relativistic Heavy Ion Collider (RHIC) and the Large Hadron Collider (LHC) is to create a novel state of matter called the quark–gluon plasma through the collision of heavy ions. This state of matter is believed to resemble the conditions of the early Universe just microseconds after the Big Bang. In non-central heavy-ion collisions, extremely strong magnetic fields are generated, primarily due to the motion of spectator charges. The magnetic field can reach magnitudes of around 10^{19} Gauss, several orders of magnitude larger than those estimated at the surface of magnetars. As the spectators move away, the rapid decay of the magnetic field induces intense electric fields, making heavy-ion collisions a unique environment to study QCD matter under extreme electromagnetic conditions. Heavy quarks, produced in the early stages of the collision and acting as non-equilibrium probes, provide a powerful tool to probe these fields. Our results show that the electromagnetic fields induce a significantly larger directed flow for charm quarks compared to light quarks, making the splitting between the directed flow of charm and anti-charm quarks a distinct signature of the produced electromagnetic field. Consequently, the directed flow of heavy mesons has been measured experimentally at both RHIC and the LHC.

Speaker's Profile

Dr. Santosh Kumar Das earned his Ph.D. in high-energy nuclear physics from the Variable Energy Cyclotron Center, Kolkata, in 2012. He worked as a postdoctoral researcher at the University of Catania, Italy, from 2013 to 2017. From December 2017 to June 2018, he served as an Associate Professor at the University of Lanzhou, China. In 2018, Dr. Das joined IIT Goa as an Assistant Professor and is currently an Associate Professor at IIT Goa.

INSA Young Associate Lecture

Bringing the Unruh Effect to the fore

Kinjalk Lochan

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The union of Quantum Field theory with the General theory of Relativity provides many remarkable and counter-intuitive theoretical results such as non covariance of the status of particles for different observers. The concept of particle creation due to motion of observers is beautifuly captured in the famous *Unruh effect* which posets that the vacuum of inertial observers appears thermally populated to accelerating ones. This central idea resonates in many prominent predictions such as the Hawking radiation from black holes, creation of particles from vacuum in Schwinger effect, initial seeding of the galaxies in the early universe, as well. Despite being of much theoretical prominence, these effects have never been realized experimentallly or obsevationally due to the extremely demanding conditions they need e.g. an atom needs to be accelerated to ~ 10^20 times the acceleration due to gravity to feel thermality of 10 K. In the recent set of works we study the field conditions which can ease out the extreme requirement of witnessing the Unruh effect in an experimental run. We argue that by appropriately tailoring the density of modes of the quantum field and invoking mechanisms like spontaneous and stimulated emissions or superradiance, the requisite acceleration scales can be brought down to much lower accelerations ~ 10^6 times the earth's gravity, or even smaller. The results from our studies appear encouraging and capable of potentially bringing the Unruh thermality to the realm of experimental verification in near future.

Speaker's Profile

Kinjalk Lochan is an Associate Professor at the Indian Institute of Science Education and Research (IISER), Mohali. He did his PhD in 2013 under the supervision of Prof. T. P. Singh at TIFR, Mumbai. Subsequently he worked with (Late) Prof. T. Padmanabhan at IUCAA Pune, and Prof. S. Shankarnarayanan at IISER Trivandrum during his post doctoral tenures. In Dec 2016 he joined IISER Mohali as DST INSPIRE Faculty and then worked as an Assistant Professor in July 2018-Dec 2023. His research primarily spans the area of quantum theory and gravity. He has been working on the topics of Black hole radiation, quantum fields in cosmology and quantum field theoretic effects in non inertial settings. For his research contributions, he was conferred N.R. Sen award by the Indian Association of General Relativity and Gravitation (IAGRG) in 2022.

INSA Young Associate Lecture

Searching for the Ghosts of Nature

Rahul Srivastava

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The Standard Model of particle physics has been an extraordinarily successful theory, yet it fails to address several fundamental phenomena such as neutrino oscillations and the existence of dark matter. These “ghosts of nature” are particles elusive to high energy colliders like the LHC, but can leave detectable imprints in low energy precision experiments and cosmological observations which we aim to explore. In this talk I will discuss the recent advances in modelling and analyzing data of the current state of the art experiments. By leveraging a broad array of terrestrial experiments such as Coherent Elastic Neutrino-Nucleus Scattering (CEνNS), Elastic Neutrino-Electron Scattering (EνES), dark matter direct detection experiments (like XENONnT, LZ and PandaX-4T), I aim to discuss the novel experimental searches for these ghost particles. I will also briefly discuss the complementary constraints provided by cosmological observables such as the effective number of relativistic species (Neff) in the early Universe.

Speaker’s Profile

Dr. Rahul Srivastava did his schooling from his hometown of Gorakhpur in Uttar Pradesh. After school he joined Gorakhpur University for his Bachelor of Science, followed by Master of Science from Banaras Hindu University, Varanasi. He then joined Centre for High Energy Physics, Indian Institute of Science, Bangalore for his PhD which he completed in 2012. During his PhD he worked on non-commutative and non-local field theories. After PhD, Dr. Srivastava joined The Institute of Mathematical Sciences, Chennai as a Post Doctoral Fellow where he remained till Jan2013. This was followed by a short stint as Post Doctoral Fellow in Physical Research Laboratory, Ahmedabad till Nov 2016. Dr. Srivastava subsequently joined Instituto de Fisica Corpuscular, Valencia, Spain as Post Doctoral Fellow for the duration Nov2016-Oct2019. He joined Physics Department, Indian Institute of Science Education and Research - Bhopal (IISER-Bhopal) as Assistant Professor in Nov2019. He is currently working in IISER-Bhopal as Associate Professor. Dr. Srivastava has worked on a number of topics beyond the Standard Model of Particle (BSM) Physics, with particular focus on Neutrino and Dark Matter physics. His current research interests include model building and phenomenological analysis of neutrino mass generation and mixing mechanisms, dark matter model building and analyzing phenomenological signatures for BSM physics, particularly in low energy (sub-GeV) terrestrial experiments and cosmological probes.