पदार्थ

PADARTH

Newsletter

Volume 3, Issue 1, December 2024

Jaypee Institute of Information Technology, Noida, U.P., India

Contents

Message from Editorial Team

We all associated with Physics are familiar with the uncertainties of the quantum world. Interestingly, there are uncertainties in the classical world, too. This issue of "Padarth" is delayed as a consequence of the uncertainties of the classical world, and we are sorry for the undesired delay in sharing the activities of the Department with our colleagues, alumni, and well-wishers. We often face relations, indicating a kind of trade-off. For example, if you increase security of a place then privacy reduces. Similarly, if you measure position of a particle in a certain direction with reasonable accuracy, you cannot simultaneously measure the component of momentum of the same particle in the same direction with accuracy. We have a somewhat similar situation here. As this issue is a bit delayed, it's full of activities. From the time of the appearance of the last issue, the PMSE Department of JIIT has organized several events of different nature including but not restricted to Journal Club talks, Women in Science talks, International Conference, Open Quantum Day and Student Conferences.

You will be happy to know that the active journey of the Department is continuing and in near future we are going to organize several programs including faculty development program, Conference, Alumni talks. Before we close, it will be apt to note that in the last few months, our colleagues and PhD students have published a large number of papers in reputed journals, and the laboratories of the Department have been enriched with a set of new equipment and facilities. The Department is becoming more exciting with the joining of new faculty members, JRFs, PhD students, new DST funded projects, and with the addition of new research facilities. It's a continuous journey towards excellence and we need cooperation from you all in making our presence visible in the global map of Physics and Materials Science education and research. Finally, we would note that recently a set of exciting results on entanglement routing has appeared from the Department where efficient protocols for entangling initially non-entangled particles present in a network are proposed. We wish that with your help, this issue of Padarth will mimic those protocols and get us entangled with the students, alumni, parents of the students, scientists working in other places, and well-wishers of the PMSE Department.

Editorial Team: Prof. Anirban Pathak, Prof. Papia Chowdhury, Dr. B. C. Joshi & Dr. Sandeep Mishra

Events Organized

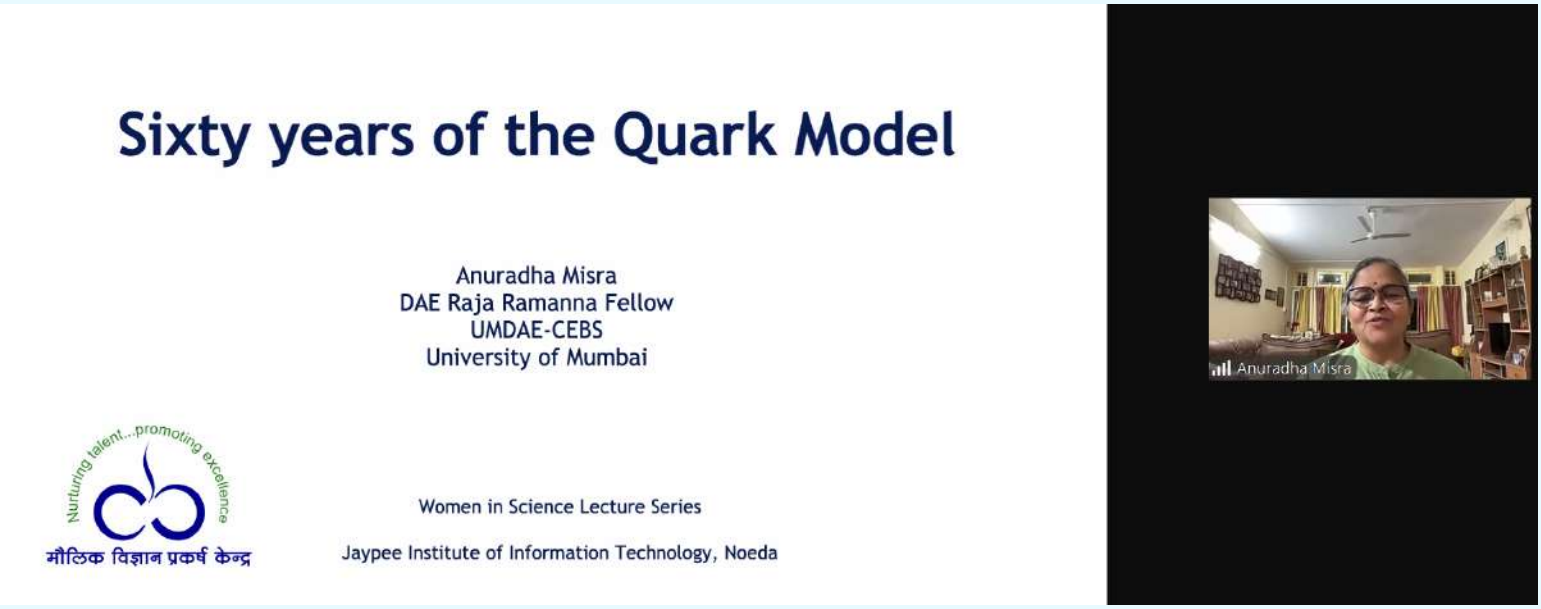
1. Women in Science Lecture Series

On the Eve of the 75 years of Independence, the National Academy of Sciences, India (NASI) is celebrating Azadi Ka Amrit Mahotsav through different science and society initiatives. As part of NASI's science and society initiative, Delhi Chapter of the NASI and Department of Physics and Materials Science and Engineering (PMSE), Jaypee Institute of Information Technology (JIIT, Noida) are jointly organizing a series of lectures entitled, "Women in Science Lecture Series". All the lectures of this series are being delivered by the eminent Women Scientists. The lectures are aimed to motivate young female students involved in UG, PG and PhD programs to continue science. All the talks had two parts. In one part, the speaker usually talked lucidly about her research works and the other part remains focused topics that inculcated confidence among the young students that even they can do top-class science and thus contribute to the society. Some practical problems that a growing scientist faces and how to circumvent those were discussed during the interaction sessions at the end. Till date eight lectures have been organized. Details of first three lectures have been published in last Padarth volume. Rest five lectures are as follows:

Women in Science Lecture 9

Ninth lecture of the series was delivered by Prof. Anuradha Mishra on 21st November 2024 at 7:00 PM. Topic of her talk was: "SIXTY YEARS OF THE QUARK MODEL". Prof. Misra completed her bachelor's degree in Mathematics, Physics, and Statistics from the University of Allahabad in 1980, followed by a master's degree in Physics from IIT Kanpur in 1983. She earned her Ph.D. in Theoretical Physics from IIT Kanpur in 1989, where she studied renormalization theory. Prof. Misra held research associate positions at the Saha Institute of Nuclear Physics and HRI Allahabad. She has also served as a visiting lecturer and guest lecturer at the

State University of New York at Stony Brook. Recently retired as the Head of the Physics Department at the University of Mumbai, she is also a Fellow of the National Academy of Sciences, India. Prof. Misra has published extensively in theoretical physics. Her current research focuses on Light Front Field Theory, Resummation Methods in QCD, and the study of single spin asymmetries in quarkonium systems.



2. Workshop on Advances in Optics and Metamaterials (WAOM 2024)

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Under Scientific Social Responsibility (SSR) scheme two days' workshop was organized on Advances in Optics and Metamaterials (WAOM-2024) from 23rd to 24th February 2024. This workshop aimed to cover the various possible research and applications based on recent advances in optics and metamaterials through a series of invited lectures from eminent speakers. Following key areas were covered: Plasmonics and nano optics, Metamaterials and Metasurfaces, near field optics, Terahertz Science and Technology, Ultrafast Optics and Applications, Integrated Photonics, Sensing and Fiber Optics.

WAOM-2024 commenced its official inauguration ceremony with the lighting of the lamp, graced by the esteemed presence of honourable Vice Chancellor Prof. B. R. Mehta, chief guests Prof. S. S. Prabhu, TIFR, Mumbai and Dr. Manukumara Manjappa, IISC Bangalore and HOD of physics department Prof. Anirban Pathak from JIIT, Noida. Joining them were our distinguished speakers of the day. Dr. Manukumara Manjappa presented talk about terahertz interactions with topological matter. The terahertz (THz) (0.1–10 THz) part of the electromagnetic spectrum encompasses astonishing prospects for emerging science and technology as it hosts many exciting and unique spectral signatures beneficial for both fundamental investigations and practical implications. Exotic platforms set by some prominent developments in THz spectroscopy has persuaded the discovery of multitude of physical phenomena in a variety of classical and quantum material systems. It has now become a go-to spectroscopy tool to probe the ultrafast and nonlinear dynamics in the emerging topological and quantum materials to unveil novel states, phases, and phenomena that are significant for the new generation optoelectronic applications. He discussed terahertz interaction with the 3D Dirac material Cadmium Arsenide and the observation of electronic phase transition in both transient and steady state regimes. Further, provided few prospects on the unique and promising spectroscopic and polaritonic signature of terahertz band for discovering the novel phenomena of light-matter matter in the realm of ultrafast and cavity-QED regimes for various applications in nonlinear and quantum domains. Prof. Gagan Kumar delivered talk on “Tera Hertz and Meta Photonics”. Prof. Gagan Kumar led a Terahertz Photonics and Plasmonics lab in Department of Physics, IIT Guwahati. He presented basics on plasmonics, metamaterials, guided wave devices, surface plasmon assisted enhanced Raman scattering and absorption etc. Talk involved both theory and experiment with the aim to develop new devices and sensors with improved speed and sensitivity. He also discussed his primary research to demonstrate terahertz plasmonic devices using corrugated structures and explore near field coupling in terahertz metamaterials and sensors. Other eminent speakers those delivered the invited talk were, 1. Prof. S. S. Prabhu from TIFR Mumbai, 2. Prof. Ranjan Singh, NTU, Singapore, 3. Prof. Rajan Jha, IIT Bhubaneswar, 4. Dr. Mukesh Jeweriya, NPL, New Delhi 5. Prof. Rajesh Kumar, IIT Roorkee 6. Prof. Mainuddin, JMI, New Delhi 7. Dr. Shashank Pandey, Intel, USA 8. Dr. Govind Dayal, University of

Delhi 9. Dr. Suraj Khanna, NPL, New Delhi 10. Dr. Akhilesh Meena, DRDO, SSPL, New Delhi 11. Dr. Anuraj Panwar, JIIT Noida. In total, 78 participants registered for the event including 35 participants from external institutes.


All type intrinsic topological beamformer
GPS Map Camera
Noida, Uttar Pradesh, India
CLASSROOM, JAYPEE INSTITUTE OF INFORMATION TECHNOLOGY, Jaypee Institute of Information Technology, A Block, Block A, Industrial Area, Sector 62, Noida, Uttar Pradesh 201309, India
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Workshop on
ADVANCES IN OPTICS
AND METAMATERIALS
(WAOM-2024)
23-24 February, 2024


(WAOM-2024)
23-24 February, 2024


Workshop on
ADVANCES IN OPTICS
AND METAMATERIALS
(WAOM-2024)
23-24 February, 2024
Department of Physics and Materials Science & Engineering
Jaypee Institute of Information Technology, Noida, India
LASER SCIENCE

3. One-week faculty development program (FDP-2023) on Quantum computing and Quantum cryptography

Department of Physics and Materials Science and Engineering organized one-week faculty development program on “Quantum computing and Quantum cryptography” from 17th-21st July 2023. A total 30 faculty members consisting of 5 external faculty members from other institutes and rest from JIIT attended the program. The talks dealt with the basics of quantum computing and quantum cryptography. Further, advanced research topics related to the recent applications and state of art activities were also discussed. It was planned in such a manner that that every day, there were 3 lectures (with adequate time for discussion) and one lab session or hands-on training using cloud-based quantum computers and/or programming platforms related to Qiskit, Qutip, Mathematica, Matlab, etc. All the participants were given a hands-on training on some useful tools such as Qiskit, Qutip, IBM quantum computers. A lab visit for the quantum cryptography was also undertaken for all the participants. The participants were introduced to the generation of unconditionally secure keys via use of COW-QKD setup in the quantum cryptography lab.

The resources persons for the FDP were three external speakers and some faculty members of the JIIT namely as follows:

1. Atul Kumar Gupta, Centre for Development of Telematics (CDOT), Delhi
2. Dr. Rama Koteswara Rao, Bennett University, Noida
3. Prof. Patrick Das Gupta, University of Delhi, New Delhi
4. Prof. Anirban Pathak, Jaypee Institute of Information Technology, Noida
5. Prof. Papia Chowdhury, Jaypee Institute of Information Technology, Noida

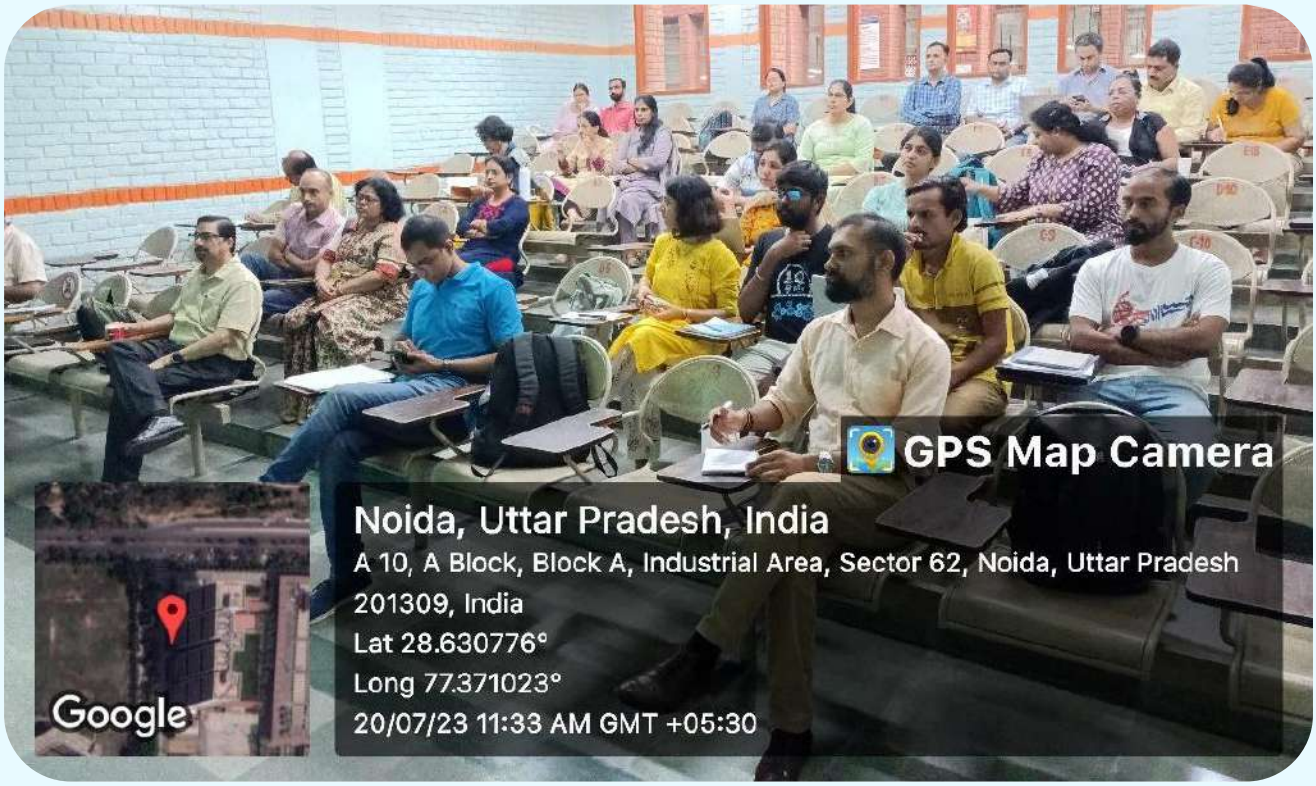
6. Dr. Sandeep Mishra, Jaypee Institute of Information Technology, Noida

7. Dr. Amit Verma, Jaypee Institute of Information Technology, Noida

8. Dr. Guruprasad Kadam, Jaypee Institute of Information Technology, Noida

During second day of the event, Plenary Talk 4 was delivered by Carlos Lopez-Mariscal, Underwater photonics, LLC Cozumel, Mexico on “Science Leadership skills for real-life”. Experienced Chief Scientific Officer with a demonstrated history of working in the Marine and Defense industry briefly discussed the skilled in global strategy and new business development, scientific communications and leadership, project management, and team leadership training. In Trivia falcon round 2 participants who qualified the first round got to compete in the final round based on technical topics. Plenary Talk 5 on “Career Opportunities in Tech” was presented by Mr. Navdeep Sandhu, Co-founder, Pepcoding. After that Ideathon Final Round consisted of two rounds: First-round involves your idea submission for the business model in a form of PPT. In total, 35 participants registered for the event including 5 participants from external institutes.


Faculty Development Program (FDP)
On
"Quantum Computing and Quantum Cryptography"
Organized by
Department of Physics and Materials Science & Engineering
Jaypee Institute of Information Technology, Noida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4. Workshop on Advanced Materials for Batteries (W4AMB)-2024

Department of Physics and Materials Science and Engineering organized Workshop on Advanced Materials for Batteries (WAMB)-2024 February 19-21, 2024. The primary objective of WAMB 2024 was to delve into the cutting-edge developments in materials that can enhance the performance, and sustainability of batteries. Attendees got the opportunity to gain insights into novel materials, and emerging technologies that have the potential to revolutionize battery technology and research labs about the recent trends in these areas. Workshop lectures were delivered in a way that participants not having prior experience in battery to understand the concept. Following key areas were covered

1.Next Generation Electrode Materials

2.Highly Conductive Materials for Electrolytes

3.Solid State Batteries

4.Nanotechnology in Battery Design.

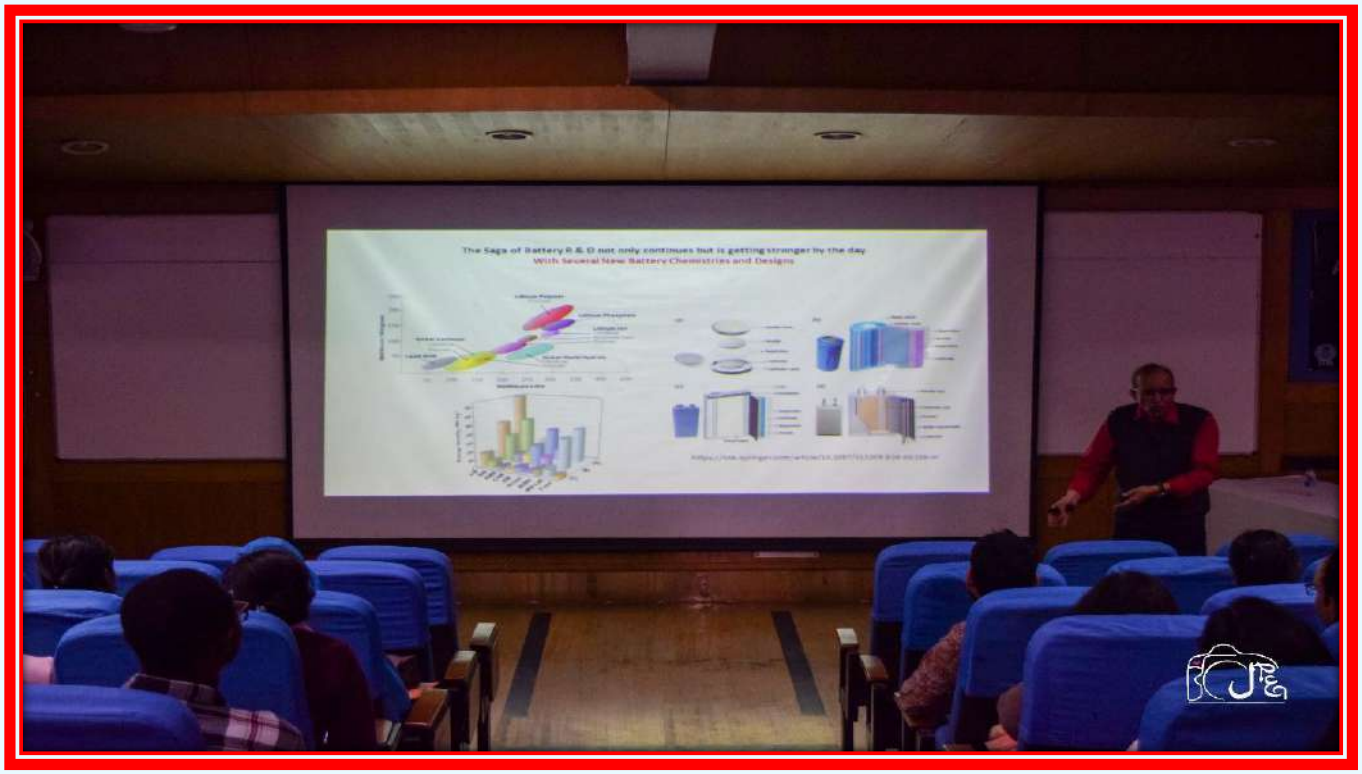
5.Sustainable Materials for Battery Application

6.Characterization Techniques (Basic to Advanced)

7.Understanding Degradation Mechanism in Battery.

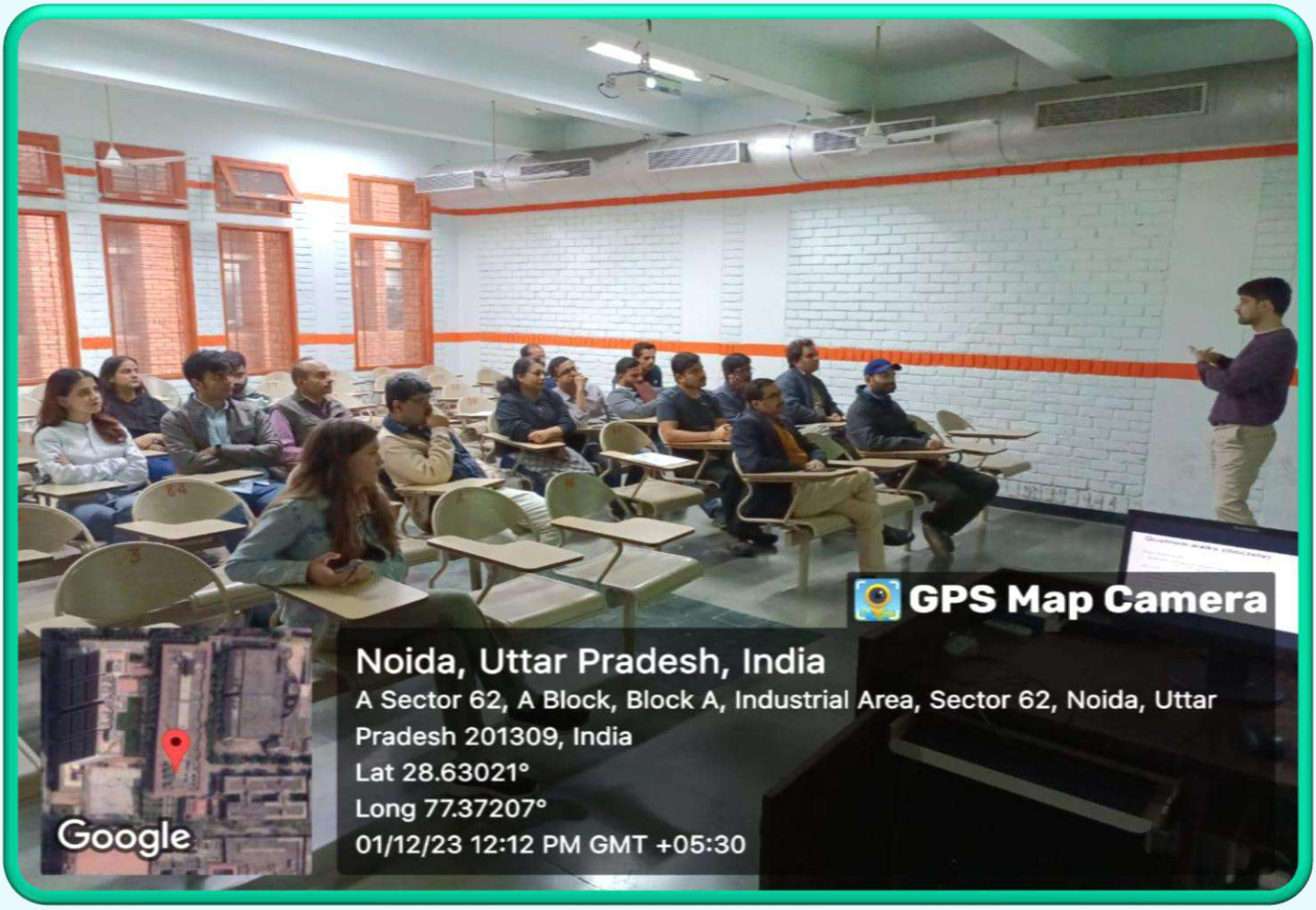
WAMB-2024 officially commenced with its inauguration ceremony, marked by the traditional lighting of the lamp. The esteemed event was graced by the honourable Vice Chancellor, Prof. B. R. Mehta, and chief guests Prof. Satish Chandra Ogale (TCG-CREST, RISE, Kolkata & IISER Pune) and Prof. Anirban Pathak (HOD, Physics Department, JIIT Noida). Our distinguished speakers for the day also joined them. Prof. Ogale delivered the inaugural address, divided into two sessions. The first session, 'Battery Science and Technology: An Exciting New R&D Frontier,' highlighted recent advancements in rechargeable battery manufacturing in India. The second session focused on 'Emergent Battery Technologies: Na-ion and Anode-Free Batteries." "The next speaker was Prof. Amreesh Chandra from IIT Kharagpur, who delivered a talk focused on Na-ion Batteries. He demonstrated how he successfully developed and delivered the product from lab to market. The subsequent speaker, Prof. S. A. Hashmi from the University of Delhi, presented on Polymer Gel Electrolyte for Rechargeable Batteries. Prof. Hashmi highlighted the crucial role of electrolytes in battery performance. The day two of the workshop was devoted to total 8 talks delivered by 4 imminent speakers from reputed organizations. The talk of the day started with Prof. Shobit Omar from IIT Kanpur. The talk was focused on Sodium Sulpher battery where Prof. Omar discussed all the pros and cons of Sulphur battery starting from basic concept to advance level research. Subsequently, Prof. Anil Kumar Verma from IIT Delhi talked about the basic terminologies and the calculation of different parameters required to fabricate as well as optimized the performance of the battery. This talk was in fact very helpful for the beginners in the area of Battery

research. In his next talk Prof. Anil Verma represented the R & D efforts that are being done in IIT Delhi in the development of rechargeable batteries. The next talk was delivered by Prof. Sagar Mitra from IIT Bombay who introduced the batteries as well as current and future trend in batteries for Evs. The final talk of the day was delivered by Prof. M. Majumdar from Monash University Australia who discussed the challenges and advancement in Lithium Sulphur batteries as well as the research activities carried out by his team in the development of Lithium Sulphur batteries at Monash University Australia. The talk of the day 3 started from the point where Prof. Majumdar has left the last talk of the day 2. The next two talks was devoted to electrolytes for batteries in which Prof. Bharat Kale from MITWPU University Pune and C-MET Pune, delivered the talk on the basics as well as R& D efforts carried out by his team in developing solid state electrolytes for rechargeable batteries. The second last talk of the workshop was delived by Prof. Ambesh Dixit from IIT Jodhpur where he discuss the basic and R &D efforts carried out at IIT Jodhpur on potential next generation energy storage system: Iron ion batteries. The last talk of the event was delivered by the convener of the workshop, Dr. Ashish Bhatnagar from JIIT Noida. Dr. Bhatnagar concentrated his talk on how to analyze the CV curve as well as R& D efforts carried out by his team at JIIT Noida on advanced anode materials and electrolytes for LI/NA ion rechargeable batteries. Finally to encourage the participants and get an idea what the participants learned through this workshop, a quiz competition was carries out by the Co-conveners; Dr. Anuraj Panwar and Dr. Dinesh Tripathi. The workshop ended with the valedictory session chaired by convener Dr. Manoj Tripathi and award distribution by Prof. Anirban Pathak, HOD, PMSE. In total, 100 participants registered for the event including 76 participants from external institutes.


The Saga of Battery R & D not only continues but is getting stronger by the day
With Several New Battery Chemistries and Designs

5. Seminar on “Recurrence in Stochastic Quantum Walk”

Aurel Gabris currently serving as Deputy Head of the Department of Physics, and a member of the Quantum dynamics, optics and information group at Faculty of Nuclear Sciences and Physical Engineering of the Czech Technical University in Prague has given a seminar lecture on 01/12/2023, 12.00 PM to 1 PM . He is also a part-time researcher at the Department of Quantum Optics and Quantum Information at the Wigner Research Center for Physics, a former unit of the Hungarian Academy of Sciences.



6. Seminar on “Leptogenesis: A possible explanation of the baryon asymmetry of the universe”

Dr. Indrani Chakraborty is currently an Assistant Professor (Senior Grade) in Jaypee Institute of Information Technology, Sector-62 Noida has given a seminar lecture on “ Leptogenesis” at **02/09/2024 between 12 PM to 1 PM** . She obtained her B.Sc. (Honours) (2006-2009) and M.Sc. degree (2009-2011) in Physics from University of Calcutta, Kolkata. She completed her Ph.D. in Particle Physics phenomenology from University of Calcutta, Kolkata in 2017. After submitting thesis, she was a post doctoral fellow at Harish-Chandra Research Institute, Allahabad (2016-2018). Prior to joining JIIT, she was a DST INSPIRE Faculty at Indian Institute of Technology Kanpur from 2018. She has guided a Ph.D. student at IIT Kanpur during her INSPIRE Faculty tenure. Her research interest spans a broad area in particle physics, in particular, model building and phenomenological aspects of beyond Standard Model (BSM) physics, collider physics, electroweak vacuum stability in the Standard Model (SM) and beyond, electroweak one-loop computations, dark matter phenomenology, cosmology, leptogenesis, possible solutions to the muon anomaly and searching for gravitational wave signatures.

7. Seminar on “Symmetry: The Grand Rule of Nature.”

Dr. Ram Lal Awasthi has given a seminar lecture on “ Symmetry: The Grand Rule of Nature at 16/03/2024 between 12 PM to 1 PM. Dr. Awasthi is currently an Assistant Professor at the Department of Physics Sri Venkateswara College, Delhi University, Since 2020. He worked as an Assistant Professor in Banasthali Vidyapith, Rajasthan prior to joining Sri Venkateswara College. Dr. Awasthi worked as a post-doctoral fellow at IISER Mohali. He obtained his Ph.D. degree from Harish-Chandra

Research Institute, Prayagraj. His research Interest is Beyond Standard Model Physics from a Grand Unification perspective.

8. Workshop on Advanced materials for Sustainable Energy (WAMSE)-2024

Department of Physics and Materials Science and Engineering, Jaypee Institute of Information technology, Noida organized two days 'Workshop on Advanced materials for Sustainable Energy (WAMSE)-2024' during November 16-17, 2024 under social-scientific responsibility (SSR) of ongoing research project titled "Tailored MXene as High Capacity and Ultrafast Mode for Lithium-Ion Batteries: Experimental and Theoretical Studies".

WAMSE-2024 explored cutting-edge materials and technologies that can drive sustainable energy solutions. The scope of WAMSE-2024 covered topics from material synthesis to real-world energy production, storage, and application solutions. This workshop offered an unmatchable platform to the scientists, researchers, academicians, and industrialist to discuss the scientific and technical advancements in these fields. Following key areas were covered in the workshop:

Energy Storage Materials and Technologies
Hydrogen Energy Materials and Technologies
Nuclear Energy Materials and Technologies
Photovoltaics and Solar Energy Materials.
Thermoelectric Materials for Energy Harvesting
Energy-Efficient Catalysis and Electrocatalysis
Advanced Materials for Carbon Capture and Utilization

The workshop witnessed eleven invited talks delivered by eminent speakers from reputed institute like HBNI Mumbai, BARC Mumbai, IIT Delhi, JNU Delhi, Jamia Milia Islamia New Delhi, Delhi University, CCS University Meerut and JIIT Noida. 84 participants attended and were benefited from this workshop.


Workshop on
ADVANCED MATERIALS
AND SUSTAINABLE ENERGY
(WAMSE-2024)
16-17 November, 2024


Executive Council of SMC-Delhi/NCR Chapter
Date of Establishment : 14th September 2023
Workshop on
ADVANCED MATERIALS
AND SUSTAINABLE ENERGY
(WAMSE-2024)

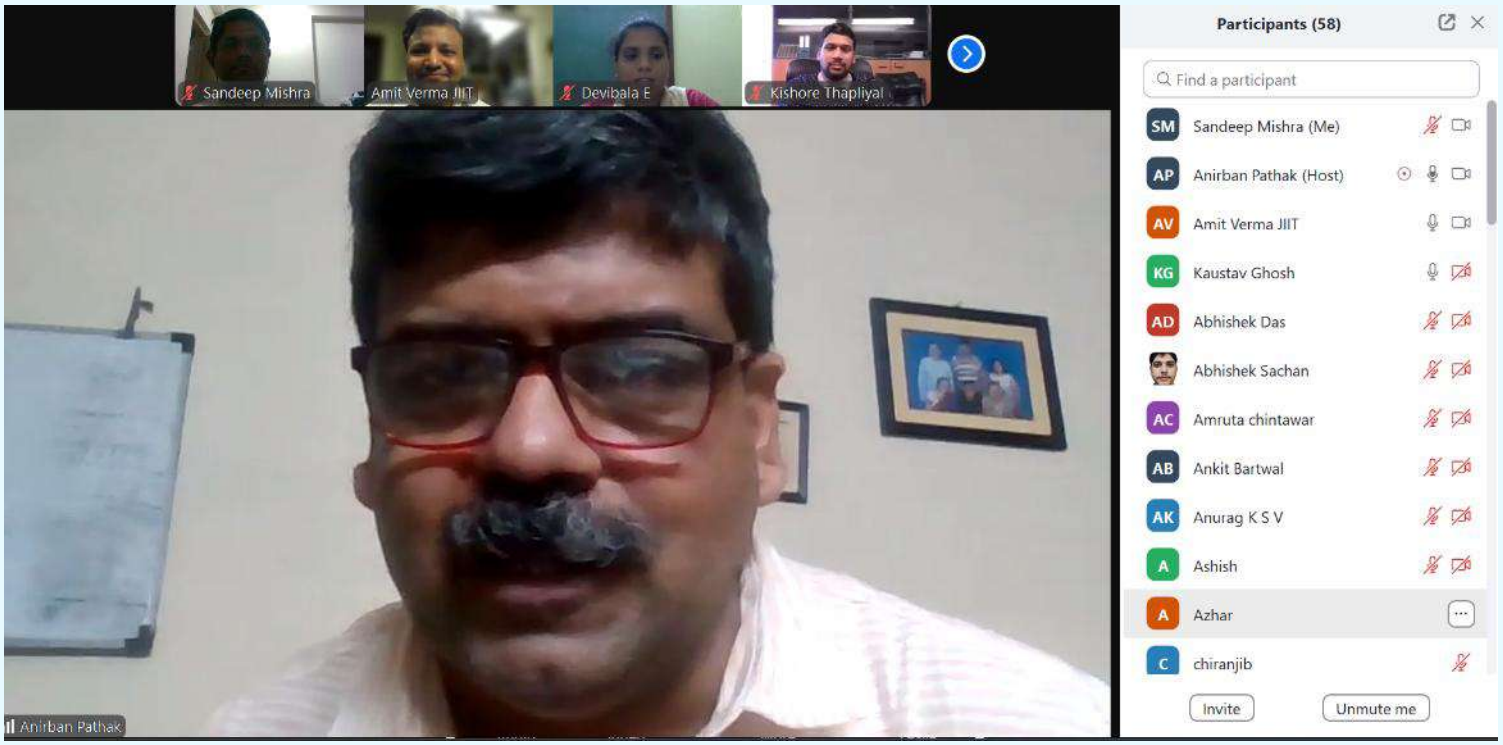

ADVANCED MATERIALS
AND SUSTAINABLE ENERGY
(WAMSE-2024)
16-17 November, 2024

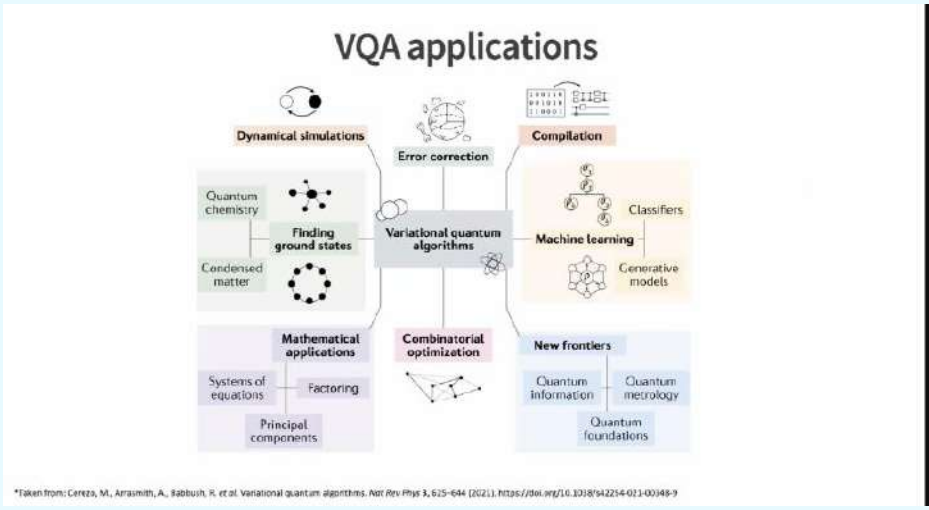
9. Seminar on “Non-Gaussian operations in quantum teleportation and quantum key distribution”

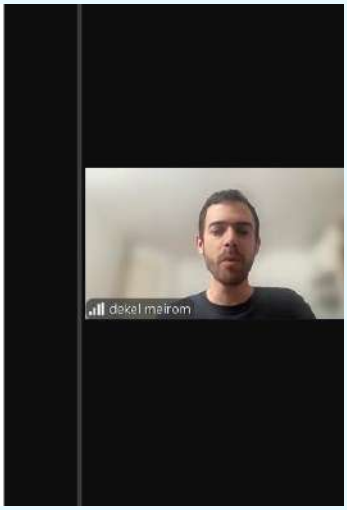
Dr. Chandan Kumar is a theoretical physicist working as a postdoctoral fellow at IMSc Chennai. He has given a talk on Non-Gaussian operations in quantum teleportation and quantum key distribution. The date of seminar was **12/06/2024 between 12.00 PM to 1 PM.** For undergraduate education, He joined IISER Mohali in 2007. He was received his BS MS in Physics from IISER Mohali in July, 2012. He continued his PhD from IISER Mohali under the guidance of Prof. Arvind. He received PhD degree in March, 2021. PhD thesis was titled “Continuous variable Gaussian and non-Gaussian states: Estimation, nonlocality and quantum key distribution”. He works in the area of continuous variable quantum information processing including quantum teleportation, quantum metrology and quantum key distribution.

10. Intentional Young Quantum Scientist's Meet 2024

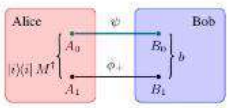
Department of PMSE organized “Intentional Young Quantum Scientist's Meet 2024” from September 16-20 September 2024. The event provided a platform where enthusiastic young researchers working in the domain of Quantum Communication, Quantum Computing, Quantum sensing, Quantum Materials and Quantum Optics can share their results and explore the avenues for new collaborations. This event was an online event. Young scientists working in China, Poland, Czech Republic, Canada, Algeria, Switzerland, Luxembourg, Belgium, Finland, Spain, Morocco, Algeria, Australia. Malaysia, Korea, Turkey, USA, UK, etc. and of course, from almost all the premier institutions of India will speak. There are about 60 short presentations which was delivered over 5 days. More than 500 young quantum scientists including students have registered from more than 35 different countries.







Simplest case: 2-qubit state, 1 shared ebit



Step 1: Bob teleports to Alice using the ebit

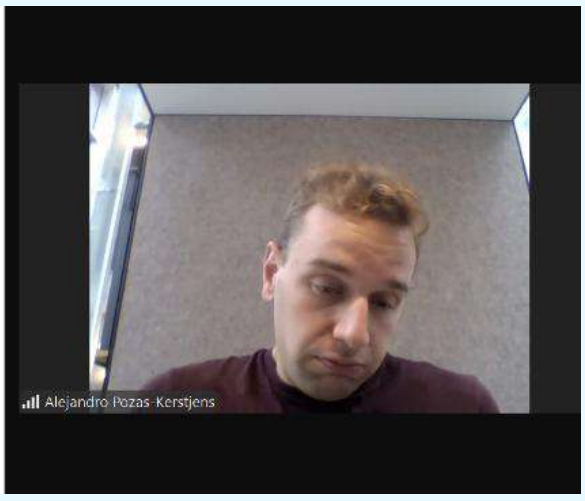
$$|\psi\rangle \to \mathbb{1} \otimes \sigma_b\,|\psi\rangle$$

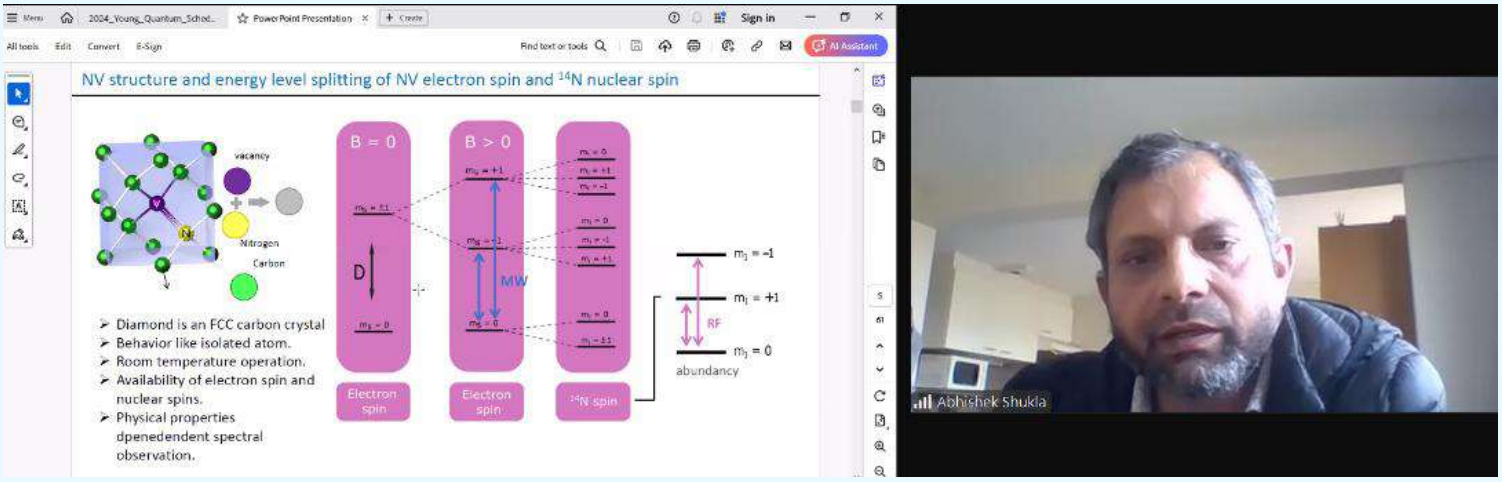
Step 2: Alice applies $M^\dagger$ to rotate the measurement basis to the computational basis

$$M = (|v_1\rangle, |v_2\rangle, |v_3\rangle, |v_4\rangle), \quad O = \textstyle\sum_i \lambda_i\,|v_i\rangle\langle v_i|$$

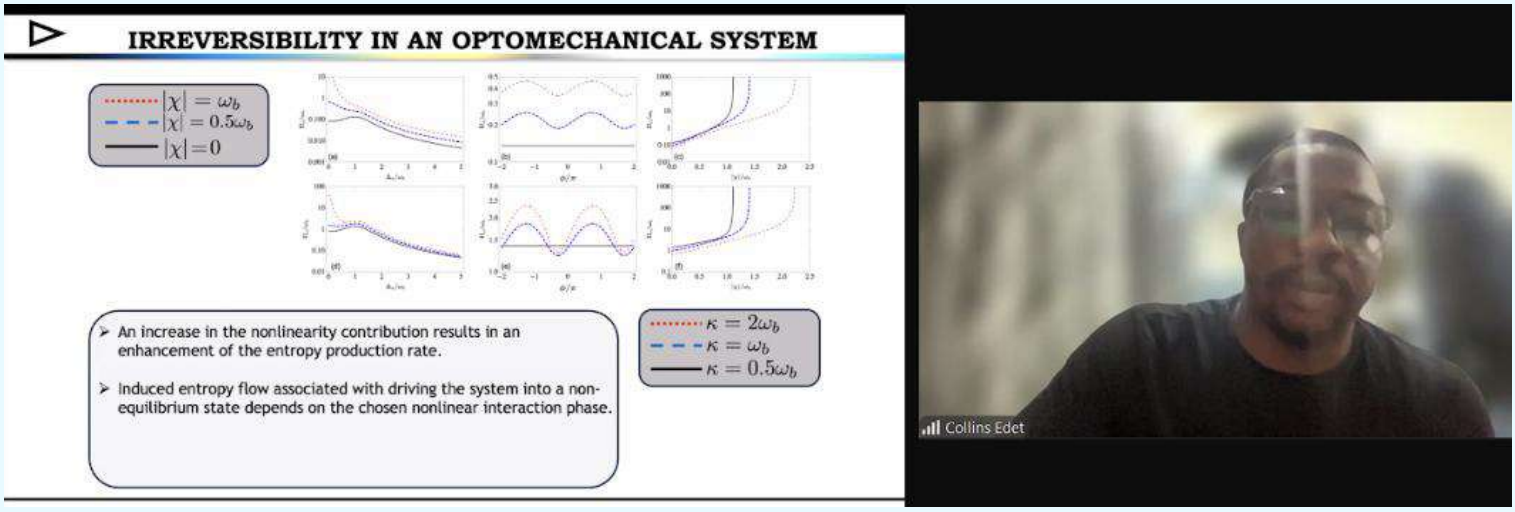
Step 3: Alice measures in the computational basis

J. Pauwels, APK, F. del Santo, and N. Gisin, arXiv:2408.00831




NV structure and energy level splitting of NV electron spin and ^{14}N nuclear spin
vacancy
Nitrogen
Carbon
B = 0
B > 0
D
MW
RF
$m_j = -1$
$m_j = +1$
$m_j = 0$
abundancy
Electron spin
Electron spin
^{14}N spin
Diamond is an FCC carbon crystal
Behavior like isolated atom.
Room temperature operation.
Availability of electron spin and nuclear spins.
Physical properties dpenedendent spectral observation.
Abhishek Shukla


Qline Architecture based
Hierarchical Quantum Secret Sharing
in Multi-Node Satellite Communication Networks
Chitra Shukla
(Research Associate)
Email: chitra.shukla@uni.lu
Interdisciplinary Centre for Security, Reliability and Trust (SnT),
University of Luxembourg, Luxembourg.
Kirchberg Campus
International Young Quantum Scientists' Meet 2024, 19 September 2024
Chitra Shukla


IRREVERSIBILITY IN AN OPTOMECHANICAL SYSTEM
$|\chi| = \omega_b$
$|\chi| = 0.5\omega_b$
$|\chi| = 0$
An increase in the nonlinearity contribution results in an enhancement of the entropy production rate.
Induced entropy flow associated with driving the system into a non-equilibrium state depends on the chosen nonlinear interaction phase.
$\kappa = 2\omega_b$
$\kappa = \omega_b$
$\kappa = 0.5\omega_b$
Collins Edet

Faculty Corner

Observation of fireball in night sky during Geminids meteor shower on December 15th, 2023

Vaibhav Rawoot, Assistant Professor, JIIT Noida

A large fireball was observed during the Geminid meteor shower on 15th December 2023 from Delhi NCR. Fireball is a very bright meteor, generally brighter than magnitude -4.

Geminid meteor shower is a prominent meteor shower visible in the night sky. Duration of the Geminid meteor shower is November 19- December 24 every year. It peaks during mid-December and is considered to be one of the best and most reliable annual meteor showers. During its peak, 120 Geminid meteorites can be seen per hour under perfect conditions.

Following is the screengrab from the video of the observed fireball.

Fig. Fireball during its maximum brightness

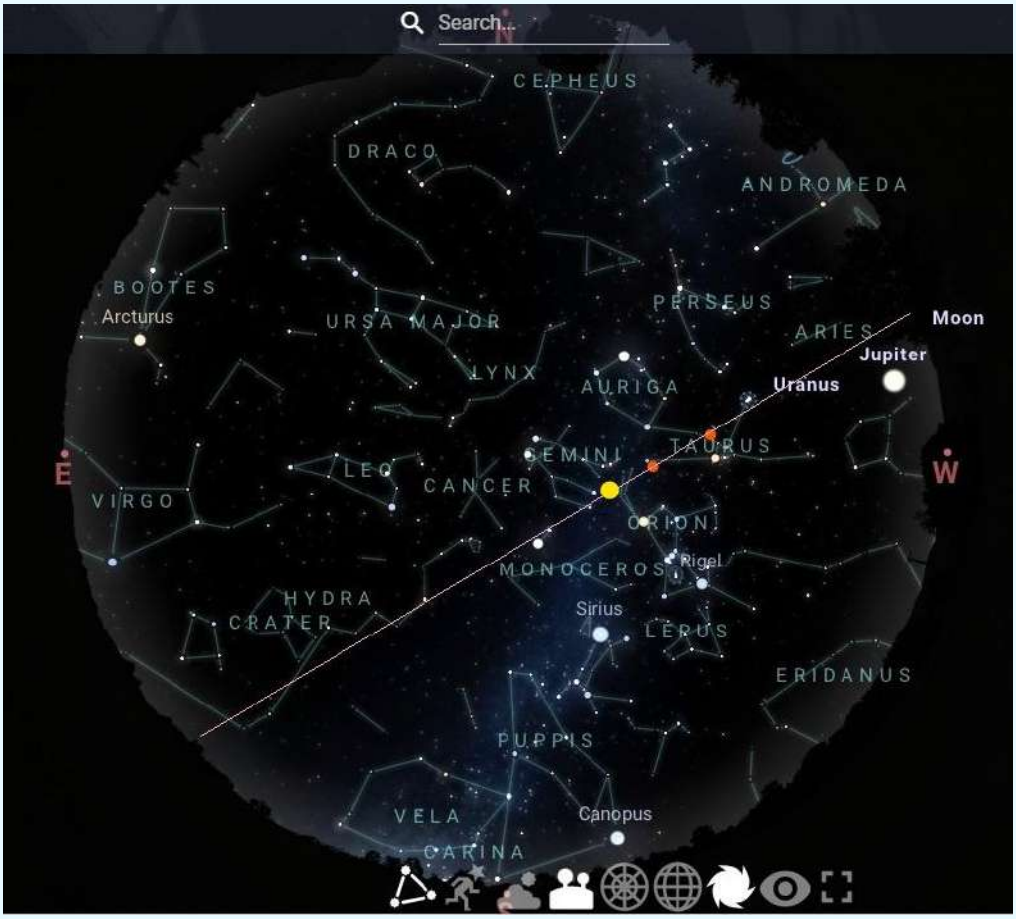


Fig. Path of the fireball shown on skymap (Credit: Stellarium)

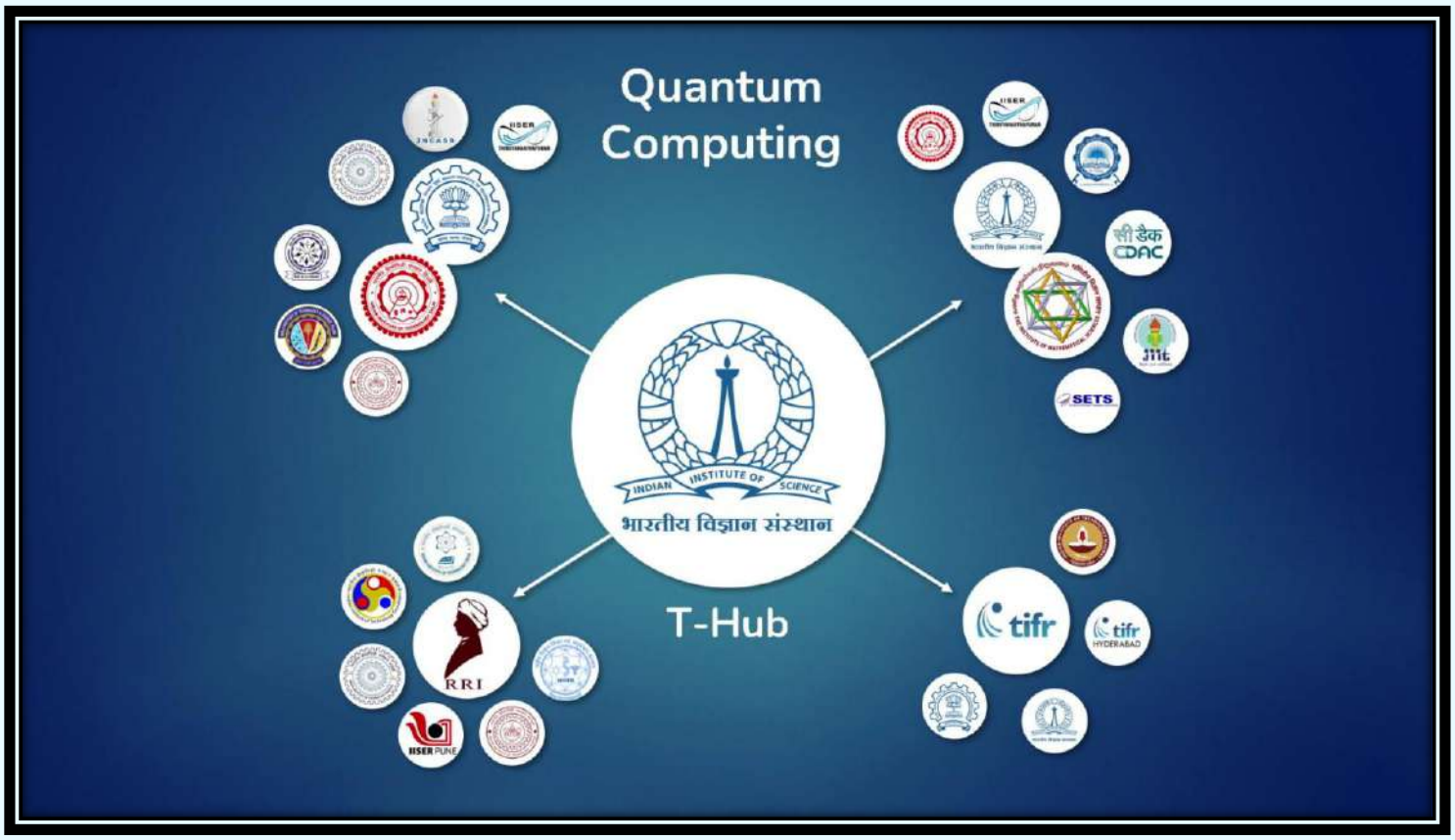
Link of the video: [Huge Fireball Observed during Geminids Meteor shower from Delhi NCR of India]

ONGOING LIST OF PROJECTS

S. No.	Principal Investigator (PI)	Co-Principal Investigator (CO-PI)	Title of Project	Funding Agency
1	Dr. Indrani Chakraborty	NA	Some Studies on the Phenomenology of the Higgs Boson and Other Scalars	DST
2	Dr. Sudip Kumar Haldar	Prof Aditi Sen(De)	A search for a suitable physical system for realising quantum technologies.	DST
3	Prof. Navendu Goswami	NA	Green synthesis and enhanced thermoelectric performance through electronic structure modification	SERB-DST
4	Dr. Anuraj Panwar	Gagan Kumar-IIT Guwahati	Exploring tunable electromagnetic induced transparency effect using exotic materials in terahertz metamaterials	SERB-DST
5	Dr. Sandeep Chhoker	NA	Developing carbon nanodot composite for waste water remediation	DRID
6	Prof. Anirban Pathak	Dr. Sandeep Mishra	Solving complex real world problems using quantum computers	Ministry of Electronics and Information Technology (MeitY)
7	Dr. Ashish Bhatnagar	Prof. Devendra Kumar Rai-JIIT & Dr. Manoj Tripathi-JIIT	Development of Li/Na rechargeable batteries based on nanostructured materials derived from metal-organic framework and metal hydrides	MHRD-SPARC
8	Dr. Vikas Malik	NA	Study of realistic models of coulomb glass system with applications to nanotechology	SERB
9	Prof. Papia Chowdhury	NA	Development of Nano Fertilizer for release of micro nutrient to plant & soil	KFCL Kanpur
10	Dr. Dinesh Tripathi	Dr. Ashish Bhatnagar	Free Standing Flexible Thermoelectric generators for Internet of Things (IOT) Devices	CST-UP
11	Prof. Anirban Pathak	Dr. Sandeep Mishra	Stability Analysis of Key Rates for COW QKD and DPS QKD	DRDO
12	Dr. Ashish Bhatnagar	Prof. D.K. Rai Dr. Dinesh Tripathi Dr. Manoj tripathi	Tailored MXene as high capacity and ultra-fast anode for lithium-ion batteries: Experimental and Theoretical Studies.	SERB
13	Dr. Ashish Bhatnagar	NA	MgH2 based heterostructure for application in hydrogen fueled devices: Experimental and theoretical Investigation.	SERB
14	Dr. Ashish Bhatnagar	Dr. R.J. Chaudhary (UGC-DAE)	Analysing MgH2(0D)/MXene(2D) heterostructure for application in hydrogen fueled devices	UGC-DAE
15	Dr. Sandeep Chhoker	NA	Synthesis and application of CVD grown 2D MoO3 and Mo2C (MXene) in energy storage and catalysis	DAE-CRS
16	Dr. Ashish Bhatnagar	Dr. Dinesh tripathi	Development of highly efficient Li ion coin cell based on MXene based anode and gel polymer electrolyte	INUP-IIT Delhi
17	Dr. Dinesh Tripathi	Dr. Ashish Bhatnagar	Thermoelectric Generator for Powering Healthcare Devices	INUP-IIT Delhi
18	Prof. Rakesh Kumar Dwivedi	NA	Studies of photocatalytic response of NaNbO3 based materials via photo-electrochemical water splitting process.	INUP-IIT Delhi

JIIT will participate in building photonic quantum computer under National Quantum Mission (NQM)

1. Hubs and Thematic Groups (TGs) formed under NQM are announced on 30 Sept, 2024.
2. Among 384 proposals, only 14 TGs are selected involving premier institutes of India.
3. JIIT is part of one of the TG to build photonic quantum computer. JIIT team will work with IISc, SETS Chennai and C-DAC, Bengaluru.
4. Budget for TG is 60 crore without overhead charges. JIIT part ~2.2 crore+overhead, and a large number of equipment procured centrally.
5. Status: Fund is sanctioned and expected to be released in 4-8 weeks.


Quantum
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Student Corner

The New Wave of Innovation: Patent Grant of the Year

La AND Fe DOPED NANBO3 FOR DYE DEGRADATION INCONTAMINATED WATER IN VISIBLE LIGHT

INVENTORS

PROF. R. K. DWIVEDI
&
MS. RAJBALA NAIN

DATE OF GRANT

17 OCTOBER 2023

Interviewed By

This year a patent has been granted to Prof. R. K. Dwivedi and Ms. Rajbala Nain. Here Ms. Rajbala Nain (hereafter RBN) shares her experiences with Mr. Mohd Saif, Research Scholar, PMSE, JIIT NOIDA

SAIF: Can you explain the key innovation covered by your patent?

RBN: The core innovation of our patent is to synthesize La and Fe modified $NaNbO_3$, which significantly enhances its photocatalytic properties. This approach utilizes a unique cationic doping technique that optimizes the material's structural and electronic characteristics, dramatically improving its performance for photocatalytic applications.

SAIF: What problem does your invention solve?

RBN: This invention specifically addresses the challenge of textile wastewater contamination, particularly the removal of Methylene blue dye. The advanced material developed which is patented, offers a highly effective solution for water remediation, providing a sustainable and efficient approach to purifying contaminated water sources.

SAIF: What is the scope of your patent's claims?

RBN: Our patent encompasses a doping strategy for $NaNbO_3$ with select cations, yielding material compositions with remarkably enhanced photocatalytic properties. It further provides the precise process parameters required to achieve these advancements, providing a comprehensive framework for optimizing material performance.

SAIF: Are there any licensing opportunities available for this patent?

RBN: Absolutely, we are open to licensing this breakthrough technology to companies within the photocatalysis sectors. We are confident that our invention offers substantial enhancements to existing products and are actively seeking strategic partners to help bring its transformative potential to market.

SAIF: Which industries or markets are most relevant for this technology?

RBN: The most relevant markets for our technology are renewable energy waste-water treatment industry, specifically in the fields of energy storage and photocatalysis. It also has potential applications in electronics and environmental remediation.

SAIF: What are your plans for further development or commercialization of this technology?

RBN: We plan to conduct more extensive testing to optimize the material properties further and explore scaling up production.

SAIF: How does your patent fit within your broader intellectual property strategy?

RBN: This patent is a cornerstone of our strategy to establish a robust intellectual property portfolio in the realm of advanced materials for photocatalysis. Our objective is to secure a diverse array of patents that encompass multiple facets of the technology, ensuring comprehensive protection while maximizing our market potential and positioning ourselves at the forefront of innovation in this field.

SAIF: Have there been any challenge or dispute regarding the validity of your patent?

RBN: To date, we have encountered no challenges or disputes regarding the validity of our patent. We have conducted an exhaustive prior art search prior to filing, and we are confident that our technology is both unique and groundbreaking.

SAIF: Are there ongoing R&D efforts related to this patent?

RBN: Indeed, we are actively expanding this technology to encompass a wider range of materials and innovative doping methods to further elevate performance.

Schrödinger’s Cat by Ms Shruti

PMSE Journal Club Talks

Speaker: Mr. Kuldeep Gangwar

Topic: Quantum Batteries on 20/01/2024, 12.00 PM to 1 PM

Abstract: In this talk, first we will talk about different kinds of batteries and how a quantum battery is different from a conventional battery. Though Several models of QB have been proposed, we will specifically talk about Dicke quantum battery and quantum harmonic oscillator battery because these models exhibit a trade-off in energy and charging time. The last part of the talk will be dedicated to presenting the experimental work related to quantum battery.

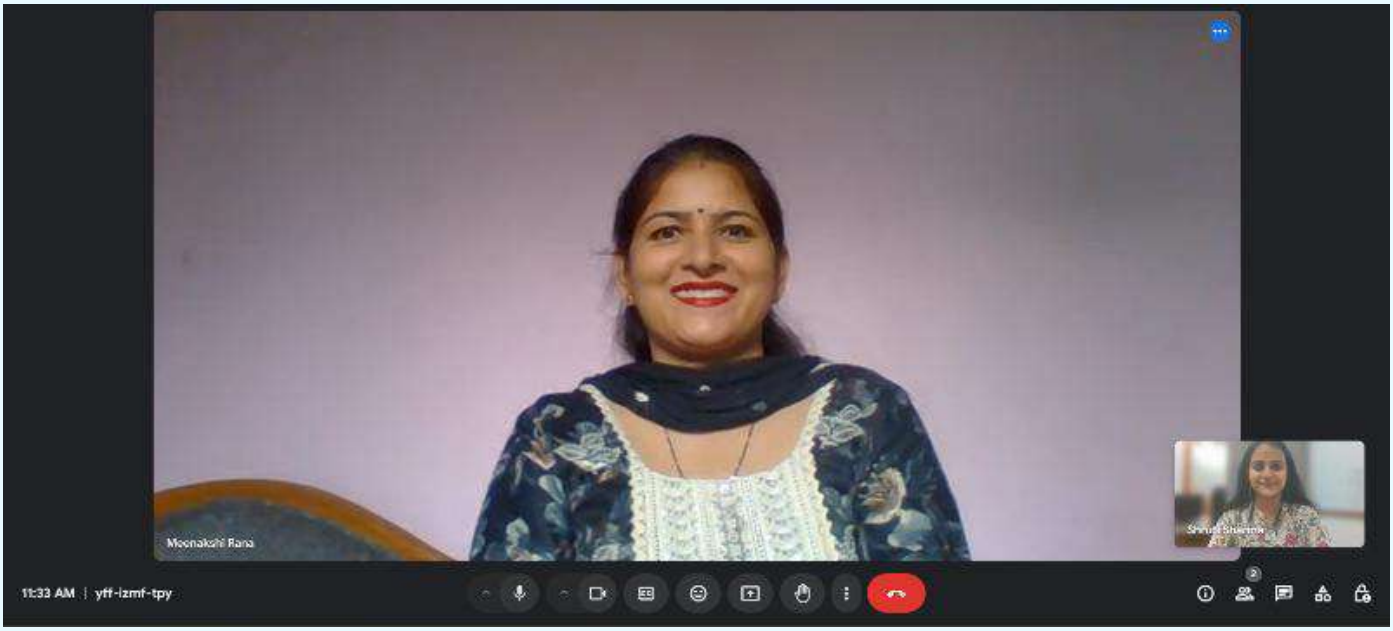
Alumni Corner

PMSE Alumni Dr. Meenakshi Rana has received the young women scientist achievement award from USERC Dehradun on 19th December 2024.

Ms. Shruti Sharma (SS hereafter), a Ph.D. student of the PMSE Department has interviewed Dr. Meenakshi Rana (MR hereafter) on different aspects of her professional life and research.

Dr. Meenakshi Rana

Ms. Shruti Sharma



Google meet interaction

SS: To start with, could you please tell us about your activities and experiences after completing your Ph.D. from JIIT and what are you currently pursuing?

MR: After completing my Ph.D. from JIIT Noida, I started an academic career that allowed me to explore deeper into my field of expertise and contribute to the academic community. Currently, I am serving as an Assistant Professor in the Department of Physics at Uttarakhand Open University, Haldwani. In this role, I am engaged in teaching various physics courses, guiding students in their research projects, and conducting my own research in areas related to my specialization.

SS: So now I will ask the first question that came to my mind. What motivated you to pursue a PhD, and how did you choose your specific research area?

MR: My motivation to pursue a Ph.D. stemmed from a deep fascination with the fundamental principles of physics and a desire to contribute to cutting-edge research. The unique properties and potential applications of quantum dots captivated my interest, as they represent a convergence of theoretical and experimental physics with real-world impact. I chose this specific research area because of its promise in advancing nanotechnology and its applications in areas such as optoelectronics, heavy metal ion detection and medical imaging.

SS: Well this is the quite good reason for choosing your research field, this may motivate students to pursue their research in their interested areas. But what strategies did you find most effective for overcoming setbacks or challenges in your research?

MR: To overcome setbacks in my research, I found several strategies effective: First, regularly consulting with supervisor provided valuable insights and alternative solutions. Breaking down complex problems into smaller, manageable tasks. Maintaining persistence and viewing challenges as learning opportunities kept me motivated.

SS: Can you talk about your relationship with your supervisor and how it influenced your research and overall PhD journey?

MR: My relationship with my PhD supervisor Prof. Papia Chowdhury was incredibly influential and supportive throughout my Ph.D. journey. As a mentor, she provided invaluable guidance, both academically and professionally. Her expertise in the field helped shape my research direction and refine my approach. Prof. Chowdhury's encouragement, strict sense of discipline, and constructive feedback were crucial in overcoming challenges and achieving my research goals. Her mentorship greatly enriched my overall Ph.D. experience and contributed to my development as a researcher.

SS: So, how did your PhD prepare you for your current career, and what skills or knowledge have been most valuable?

MR: My Ph.D. provided a strong foundation for my career as an Assistant Professor in physics by equipping me with both in-depth subject knowledge and essential academic skills. The rigorous research training polished my ability to conduct independent research, critically analyze data, and develop innovative solutions to complex problems. Research provided me a perspective of evidence-based teaching strategies and sense of enhancing the critical thinking skills among the students. After familiarizing myself with the instruments and principles during research, it was more effective to impart this knowledge to the students. Additionally, the experience of publishing papers and presenting at conferences enhanced my communication skills, allowing me to effectively share knowledge with students.

SS: Is there anything you would have done differently during your PhD program to enhance your academic or professional development?

MR: I would have pursued more collaboration with biotechnology and chemistry to integrate interdisciplinary approaches into my research. This could have expanded my understanding of how physics intersects with these fields, leading to innovative solutions and broader applications of my work. Engaging in such collaborations would have enriched my academic and professional development by providing new perspectives and opportunities for impactful research.

SS: How do you feel about your decision to pursue a Ph.D. as a woman? Do you believe it was the right choice for you?

MR: Pursuing a Ph.D. as a woman has been a satisfying and empowering decision. It has allowed me to make significant contributions to my field, overcome challenges, and inspire others. Despite the obstacles, I believe it was the right choice, as it aligns with my passion for physics and has provided me with opportunities for personal and professional growth. Additionally, balancing family responsibilities, and research activities has cultivated a sense of equilibrium in me. This also developed a sense of multitasking in me.

SS: How challenging was it to balance family responsibilities while pursuing your Ph.D., and what advice would you give to other Ph.D. students who are in similar situations?

MR: Balancing family responsibilities while pursuing my Ph.D. was undoubtedly challenging, requiring careful time management, clear communication, and a strong support system. It was essential to set priorities, maintain a flexible schedule, and seek support from family and peers when needed.

My advice to Ph.D. students in similar situations is to stay organized, openly communicate your needs and limitations, and don't hesitate to ask for help. Schedule regular breaks to rest and recharge. Short breaks throughout the day can boost productivity and prevent burnout. Remember to maintain a positive mindset and be kind to yourself.

SS: What would you like to say to other female students who are struggling in PhD or to pursue research career after PhD because of their family, children or any other social boundaries.

MR: To other female students facing challenges during their Ph.D. or considering a research career afterward, I would say: Believe in your capabilities and stay determined. It's important to seek support from your network and communicate your needs clearly. Balancing family responsibilities with academic demands is tough, but setting clear goals, seeking support, and prioritizing self-care are key. Don't hesitate to reach out for help from mentors, colleagues, and family. Remember that your unique perspective and contributions are valuable, and pursuing your passion in research is entirely possible with the right support and strategies.

SS: What advice would you give to current PhD students to help them succeed and make the most of their time in the PhD?

MR: Stay curious and passionate about your research, and maintain regular communication with your advisor. Continuously enhance your research skills through workshops and conferences. Engage with peers and network within your field to gain varied insights. Organize your time well while maintaining a healthy work-life balance. Persist through challenges and view them as opportunities for growth and learning. Never hesitate to pursue collaborations, as significant collaborations often result in remarkable innovations.

SS: Thank you so much, ma'am. It was a very helpful and wonderful talk. Your journey will undoubtedly motivate new young researchers, especially females, to never compromise your research career because of any social boundaries. You have truly set an example as an excellent researcher, supervisor, wife and specially as a good mother. We all know that maintaining your career, job as a mother is really challenging but you not only handled your Ph.D. while taking care of family and kids but also continued your research even now. It's truly marvelous.

Alumni Talk-1

Speaker: Mr. Prakash Gupta.

Title of the Talk: Product Lifecycle and Roles Beyond SWE, 13th September 2024

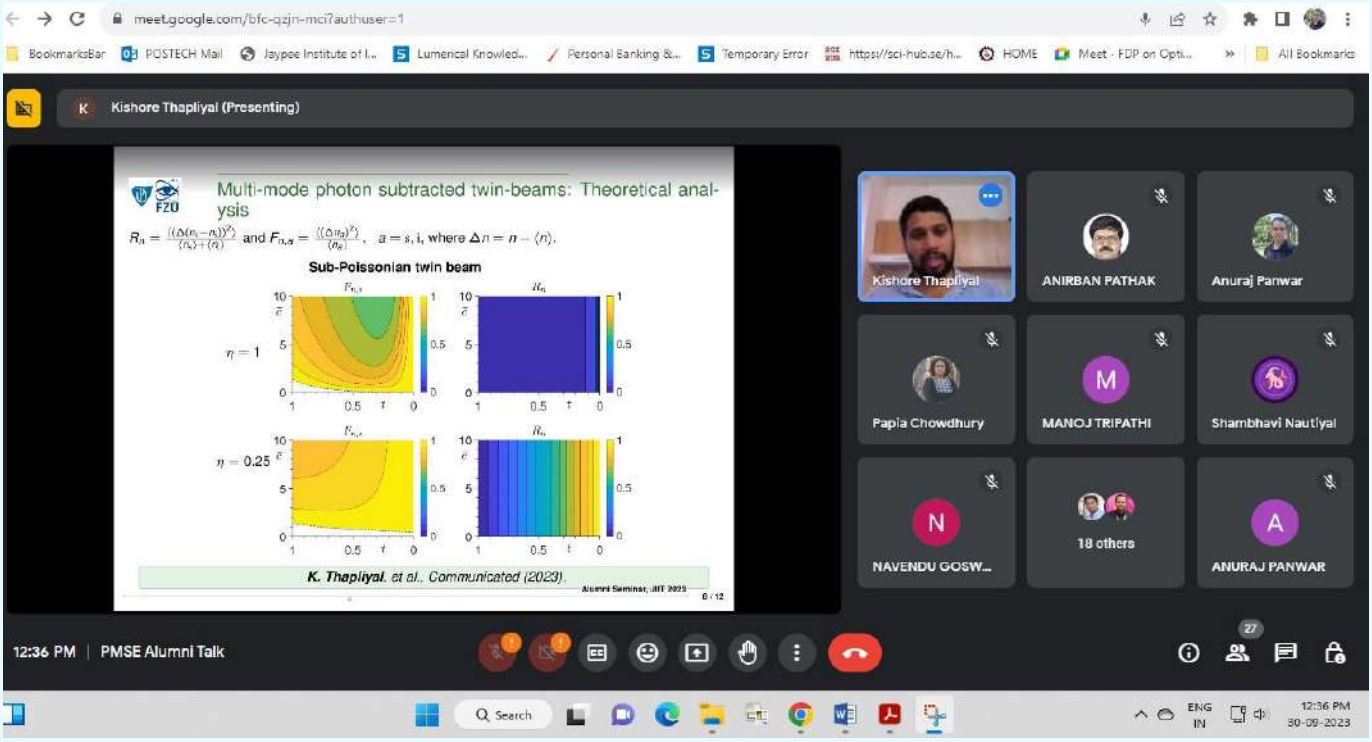
Mr. Gupta is a distinguished alumni of JIIT. He was a student of the first batch of JIIT, and recipent of the Gold medal as a topper of the batch. After graduating from JIIT in 2005, he did MS in USA and subsequently joined Google, USA. After working on many projects and leading a few critical projects of Google, now he works as Staff Technical Program Manager, YouTube. He has delivered the alumni talk followed by an interaction with the students. Among other aspects the talk will also include a short discussion on the impact of basic sciences in the career of a SWE. He did his final project in the PMSE department leading to multiple publications in international journals in the area of quantum optics and quantum communication.

Alumni Talk-2

Speaker: Dr. Kishore Thapliyal

Title of the Talk: Generation and characterization of sub-Poissonian twin beams, 30th September 2023, Saturday

Our speaker was Dr. Kishore Thapliyal from Joint Laboratory of Optics, Faculty of Science, Palacký University, Olomouc, Czech Republic. Dr. Kishore Thapliyal joined Palacky University Olomouc, Czech Republic as postdoctoral fellow after completing his Ph.D. from JIIT. His research interest has been quantum optics and quantum information processing. He is currently working on the experimental feasibility of generation of engineered quantum states for several aspects of quantum technologies. He has published more than fifty research papers in international journals. He talked about his current research area of interest "Generation and characterization of sub-Poissonian twin beams". Talk was attended by 26 participants from JIIT and outside.



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