# PHOTONICS 2023

## CONFERENCE PROGRAM




WWW.PHOTONICS2023.NET

The International Conference on Photonics is a premier conference in the emerging areas of Photonic science and technologies. The first Photonics conference (then named as CEOT-92 and later rechristened as Photonics) was held at Indian Institute of Science (IISc) Bengaluru in 1992. Since then, the conference is being organized biennially in different parts of the country. Photonics 94, 96, 98, 2000, 2002, 2004, 2006, 2008, 2010, 2012, 2016 and 2018 were organized by IISc Bangalore, TIFR Mumbai, IIT Delhi, IIT Bombay, CUSAT Cochin, Univ. of Hyderabad, IIT Madras, IIT Guwahati, IIT Kharagpur (jointly with Univ. of Calcutta and CGCRI), IIT Kanpur and IIT Delhi. We are very glad that after almost three decades it has come back to IISc Bengaluru! Over the years, the conference has evolved to the leading forum and is presently acknowledged as one of the most important conferences in this area. The Biennial Photonics Conference will be organized at IISc, Bengaluru on 5th -8th July 2023, the Photonics Conference will cover vast technical areas within the photonics community. Attendees will be able to participate in Plenary Sessions, Invited Talks, Panel Discussions, Tutorial Sessions, Doctoral Symposium, and Industry Interactions, across the conference's topical areas.

<table>
<tr><th>Time/Day</th><th colspan="5">DAY-1: 5th July ’23, Wednesday</th></tr>
<tr><td rowspan="8">9:00-11:00</td><td></td><td>J.N Tata main auditorium</td><td>Seminar Hall A</td><td>Seminar Hall B</td><td>Seminar Hall C</td></tr>
<tr><td></td><td>Doctoral Symposium</td><td>Tutorial- 1 (Academic)</td><td>Tutorial-2 (Ansys)</td><td>Tutorial-3 (Springer)</td></tr>
<tr><td>09:00-09:20</td><td>Ajay Puniya, IISER Bhopal</td><td>Prof. K. Thyagarajan, (Formerly Professor of Physics, IIT Delhi)</td><td>Mr. Nikhil Dhingra</td><td>Ms. Kamiya Khatter</td></tr>
<tr><td>09:20-09:40</td><td>Himanshu Bansal, Dayalbagh Educational Institute, Agra</td><td rowspan="5">Title: Integrated Quantum Photonics</td><td rowspan="5">Title: Metalens Design: a Complete Workflow using Ansys Lumerical and Ansys Zemax OpticStudio</td><td rowspan="5">Publishing in Springer Journals</td></tr>
<tr><td>09:40-10:00</td><td>Sunaina Rajora, IIT Delhi</td></tr>
<tr><td>10:00-10:20</td><td>Varsha Lohani, IIT Kanpur</td></tr>
<tr><td>10:20-10:40</td><td>Shivani Sharma, IIT Delhi</td></tr>
<tr><td>10:40-11:00</td><td>Niladri Modak, IISER Kolkata</td></tr>
<tr><td>11:00-11:15</td><td></td><td colspan="4">Tea/Coffee Break</td></tr>
<tr><td>11:15-13:15</td><td></td><td colspan="4">Women in Optics: Panel Discussion<br>Moderator: Dr. Parama Pal (Senior Scientist, TCS Bengaluru), Venue: J.N Main Tata Auditorium</td></tr>
<tr><td>13:15-14:00</td><td></td><td colspan="4">LUNCH</td></tr>
<tr><td>14:00 - onwards</td><td></td><td colspan="4">CONFERENCE REGISTRATION</td></tr>
<tr><td rowspan="4">14:00-16:00</td><td rowspan="4"></td><td>J.N Tata main auditorium</td><td>Seminar Hall A</td><td>Seminar Hall B</td><td>Seminar Hall C</td></tr>
<tr><td>Tutorial-7 (Optica)</td><td>Tutorial-5 (Academic)</td><td>Tutorial-4 (Ansys)</td><td>Tutorial-6 (Siemens Healthineers)</td></tr>
<tr><td>Prof. Prem Kumar (Northwestern University, USA)</td><td>Prof. Subhasish Dutta Gupta (TIFR Hyderabad)</td><td>Mr. Nikhil Dhingra</td><td>Dr. Mohiudeen Azhar</td></tr>
<tr><td>Publishing in Optica Journals (2PM-3PM)</td><td>Title: An Introduction to Plasmonics, Nano optics and Spin optics</td><td>Title: Photonic Integrated Circuit Design: a comprehensive tutorial using Ansys Lumerical</td><td>Title: Optics in Medical Diagnostics-Shedding light on Blood tests</td></tr>
<tr><td>16:00-16:30</td><td></td><td colspan="4">High-Tea</td></tr>
<tr><td>16:30-16:45</td><td></td><td colspan="4">INAUGURAL CEREMONY<br>Venue: J.N Tata Main Auditorium</td></tr>
<tr><td>16:45-17:45</td><td></td><td colspan="4">PLENARY TALK–1: Engineering Challenges for the Emerging Quantum Networks<br>Prof. Prem Kumar (Northwestern University, USA)<br>Venue: J.N Tata Main Auditorium</td></tr>
<tr><td>17:45-18:15</td><td></td><td colspan="4">Session Break</td></tr>
<tr><td rowspan="3">18:15-20:00</td><td>18:15-19:00</td><td colspan="4">Industry Keynote: Convergence of multiple technologies shaping the future of society: Photonics is at the heart of it. Mr. Kailash Narayanan (Senior Vice President, Keysight Technologies)</td></tr>
<tr><td>19:00-19:30</td><td colspan="4">Industry Talk-1: Instrumentation for Facilitating the Advancements of Photonics Research.<br>Mr. Niloy Roy (Joint Director, ATOS Instruments, Bangalore)</td></tr>
<tr><td>19:30-20:00</td><td colspan="4">Industry Talk-2: Thorlabs; an Introduction and Capabilities<br>Mr. Jan-Niklas Weimar (Technical Support Engineer, Thorlabs)<br>Venue: J.N Tata Main Auditorium</td></tr>
<tr><td>20:00-21:30</td><td></td><td colspan="4">DINNER</td></tr>
</table>

| Time/Day | DAY-2: 6th July '23, Thursday | | | |
|---|---|---|---|---|
| 9:00-10:30 | J.N Tata main auditorium | Seminar Hall A | Seminar Hall B | Seminar Hall C |
| | **SESSION-1A** (Quantum optics/ photonics-1) | **SESSION-1B** (Fibers Applications and Optical Sensors-1) | **SESSION-1C** (Lasers and Applications-1) | **SESSION-1D** (Optical communication and networks-1) |
| **10:30-10:50** | **Tea/Coffee Break** | | | |
| **10:50-11:50** | **PLENARY TALK–2:** Precision Motorized Raman Nanosensors: New Paradigm for Biosensing. **Prof. Donglei Emma Fan (The University of Texas at Austin, USA)** **Venue: J.N Tata Main Auditorium** | | | |
| **11:50-12:00** | **Session Break** | | | |
| **12:00-13:30** | J.N Tata main auditorium | Seminar Hall A | Seminar Hall B | Seminar Hall C |
| | **SESSION-2A** (Nanophotonics-1) | **SESSION-2B** (Special topics in Photonics-1) | **SESSION-2C** (Biophotonics and Bioimaging-1) | **SESSION-2D** (Photonic integrated circuits-1) |
| **13:30-15:00** | **LUNCH and POSTER SESSION-01 (P01-P78)** | | | |
| **15:00-16:30** | J.N Tata main auditorium | Seminar Hall A | Seminar Hall B | Seminar Hall C |
| | **SESSION-3A** (Quantum optics/ photonics-2) | **SESSION-3B** (Fibers Applications and Optical Sensors-2) | **SESSION-3C** (Biophotonics and Bioimaging-2) | **SESSION-3D** (Nonlinear and Ultrafast photonics-1) |
| **16:30-16:50** | **Tea/Coffee Break** | | | |
| **16:50-18:20** | J.N Tata main auditorium | Seminar Hall A | Seminar Hall B | Seminar Hall C |
| | **SESSION-4A** (Nanophotonics-2) | **SESSION-4B** (Special topics in Photonics-2) | **SESSION-4C:** (ISOI-PHOTONICS SESSION on Optical metrology, Instrumentation and optofluidics-1) | **SESSION-4D** (Optoelectronics-1) |
| **18:20-18:30** | **Session Break** | | | |
| **18:30-20:30** | **CULTURAL PROGRAM: Yakshagana (A traditional Art from coastal Karnataka)** **Venue: J.N. Tata Main Auditorium** | | | |
| **20:30-22:00** | **DINNER** | | | |

| SESSION-1 | 6th July '23, Time: 09:00-10:30 |
|---|---|
| **SESSION-1A: QUANTUM OPTICS/PHOTONICS-1** | **Venue: J.N Tata Main Auditorium** |
| **09:00 – 09:30** | INVITED TALK-01: Quantum Experiments with Satellite Technology.<br>**Prof. Urbasi Sinha (RRI Bangalore)** |
| **09:30 – 10:00** | INVITED TALK-02: Entangled photon sources for free space and fiber-based quantum communication.<br>**Prof. Joyee Ghosh (IIT Delhi)** |
| **10:00 – 10:15** | QOP-01**:** Energy-Dependent Spontaneous Emission of Nitrogen Vacancy Centres.<br>**Debojyoti Ray Chawdhury (IIT Madras)** |
| **10:15 – 10:30** | QOP-02: An Uncertainty-Based Unified Approach Towards Quantum Synchronization and Entanglement in Optomechanical Systems.<br>**Manju (IIT Ropar)** |
| **SESSION-1B: FIBER APPLICATIONS AND OPTICAL SENSORS-1** | **Venue: Seminar Hall A** |
| **09:00 – 09:30** | INVITED TALK-03: Detecting Acoustics using Light - Opportunities and Challenges in Distributed Acoustic Sensing.<br>**Prof. Balaji Srinivasan (IIT Madras)** |
| **09:30 – 09:45** | FOS-01: Optimised Design of Bend Compensated Ultra Low Graded Index Fiber.<br>**Soorej Thekkeyil (IIT Delhi)** |
| **09:45 – 10:00** | FOS-02: Development of LSPR Based Optical Fiber Sensor Employing Graphene Oxide (GO) for the Detection of Mercury in Water. **Fatima Banoo (IIT Guwahati)** |
| **10:00 – 10:15** | FOS-03: High Sensitivity Refractometer Based on Thermally Stable Turnaround Point Long Period Fiber Grating.<br>**Sudhir Kumar (Raja Ramanna Center for Advanced Technology, Indore)** |
| **10:15 – 10:30** | FOS-04: Raman Distributed Temperature Sensor Performance Analysis Using Wavelet Techniques.<br>**Prof. Prasant Kumar Sahu/Prof. Rajan Jha (IIT Bhubaneshwar)** |
| **SESSION 1C: LASERS AND APPLICATIONS-1** | **Venue: Seminar Hall B** |
| **09:00 – 09:30** | INVITED TALK-04: Development of High Power Lasers: Technology Challenges and Capabilities.<br>**Dr. Jagannath Nayak (CHESS, DRDO Hyderabad)** |
| **09:30 – 09:45** | LA-01: 1kW Narrow-Linewidth CW Fiber Laser Source for Spectral Beam Combining.<br>**Thejna Ros Joseph (Bharat Electronics Limited)** |
| **09:45 – 10:00** | LA-02: Effect of Amplitude-Phase Coupling on the Formation of Dissipative Topological Defects in Coupled Lasers.<br>**Sahil Sahoo (IIT Ropar)** |
| **10:00- 10:15** | LA-03: Aberration Laser Beams with Controlled Autofocusing, Self-Healing and Intensity Distribution.<br>**Vasu Dev (IIT Ropar)** |
| **10:15- 10:30** | LA-04: Diffraction Coupling of Class-A VECSEL Arrays: Experiment and Model.<br>**Sopfy Karuseichyk (Universite Paris Saclay, France)** |
| **SESSION 1D: OPTICAL COMMUNICATION AND NETWORKS-1** | **Venue: Seminar Hall C** |
| **09:00 – 09:30** | INVITED TALK-05: Photonic Analog to Digital Converters-Challenges and Opportunities.<br>**Prof. Deepa Venkitesh (IIT Madras)** |
| **09:30- 09:45** | OCN-01: A Novel Fiber-Optic Parametric Amplifier Scheme with Switchable Large-Gain and Low-Noise Modes.<br>**Debanuj Chatterjee (IIT Madras)** |
| **09:45 -10:00** | OCN-02: Impact of Wireless Channel Noise on Seamless Wireless-To-Photonic Symbol Mapping.<br>**Niloy Ghosh (IIT Kharagpur)** |
| **10:00 – 10:15** | OCN-03: Effect of Second Order Spatial Chirp in Ring Airy Vortex Beam on the Scintillation Index Evolution in Turbulent Atmosphere. **Shakti Singh (IIT Roorkee)** |
| **10:15 – 10:30** | OCN-04: PAM 4 Transmission over OM3 Fiber Using OAM Mode Group Multiplexing<br>**Abhishek Mani Shukla (IIT Patna)** |

| SESSION-2 | 6th July '23, Time: 12:00-13:30 |
|---|---|
| **SESSION 2A: NANOPHOTONICS-1** | **Venue: J.N Tata Main Auditorium** |
| **12:00-12:30** | INVITED TALK-06: Broadband optical response and dynamics in plasmonic nanostructures.<br>**Prof. Parinda Vasa (IIT Bombay)** |
| **12:30-13:00** | INVITED TALK 07: Metamaterials for physics and applications.<br>**Prof. Achantha Venugopal (TIFR Mumbai)** |
| **13:00-13:15** | NP-01: Understanding the Role of Chemical Interface Damping (CID) in Tuning Plasmon-Exciton Coupling.<br>**Jyotirban Dey (IIT Kanpur)** |
| **13:15-13:30** | NP-02: Ultrabroadband Plasmonic Meta-Absorber Using Hybrid Split Ring Nanostructures.<br>**Bodhan Chakraborty (IIT Guwahati)** |
| **SESSION 2B: SPECIAL TOPICS IN PHOTONICS-1** | **Venue: Seminar Hall A** |
| **12:00-12:30** | INVITED TALK-08: Quantum Vacuum Dressed Materials in Terahertz Cavities.<br>**Prof. Junichiro Kono (Rice University)** |
| **12:30-13:00** | INVITED TALK-09: Quantum transduction of superconducting qubit in hybrid optomechanical system.<br>**Prof. Amarendra Kumar Sarma (IIT Guwahati)** |
| **13:00-13:15** | STP-01: An Experimental Realization of Optical Hilbert Hotel in Polarization.<br>**Anirban Ghosh (PRL Ahmedabad)** |
| **13:15-13:30** | STP-02: High-Tc Pearl Meta-Superinductor.<br>**Dr. Yogesh Kumar Srivastava (IIT Hyderabad)** |
| **SESSION 2C: BIOPHOTONICS AND BIOIMAGING-1** | **Venue: Seminar Hall B** |
| **12:00-12:30** | INVITED TALK-10: Vibrational spectroscopy for rapid bedside medical diagnosis.<br>**Prof. Senthil Murugan Ganapathy (University of Southampton, UK)** |
| **12:30-13:00** | INVITED TALK-11: High-Resolution Optical Coherence Microscopy and Tomography of Biological Cells and Tissues: Effect of high spatial coherence of laser light on spatial phase sensitivity and accuracy in phase measurement.<br>**Prof. Dalip Singh Mehta (IIT Delhi)** |
| **13:00 – 13:15** | BB01: A Cost-Effective Implementation of Optical Super-Resolution Microscopy with STORM.<br>**Anupam Bharadwaj (IIT Guwahati)** |
| **13:15-13:30** | BB02: Membrane and Periplasmic Permeability to Drug Transport Increases Inside Osmotically Shocked Gram-Negative Bacteria Escherichia Coli.<br>**Deepak Kumar (IIT Kanpur)** |
| **SESSION 2D: PHOTONIC INTEGRATED CIRCUITS-1** | **Venue: Seminar Hall C** |
| **12 00 – 12 30** | INVITED TALK-12: Light emission from Semiconductor and Plasmonic Nanoantennas.<br>**Prof. Naresh Kumar Emani (IIT Hyderabad)** |
| **12:30-13:00** | INVITED TALK-13: Special filters for Silicon Photonic Integrated Circuits.<br>**Prof. Bijoy Krishna Das (IIT Madras)** |
| **13:00 – 13:15** | PIC-01: Accessible Soliton Breathers in Diffraction-Managed Media.<br>**Manoj Mishra (Mody University of Science and Technology, Lakshmangarh)** |
| **13:15-13:30** | PIC-02: Optimization of Ring Modulators in Interferometric Structure for High-Speed Applications.<br>**Rupa G Minasamudram (Global Foundries, India)** |

| SESSION-3 | 6th July '23, Time: 15:00-16:30 |
|---|---|
| **SESSION 3A: QUANTUM OPTICS AND PHOTONICS-2** | **Venue: J.N Tata Main Auditorium** |
| **15:00 – 15:30** | INVITED TALK-14: Hong-Ou-Mandel interferometry-based quantum sensor.<br>**Prof. Goutam Samanta (PRL Ahmedabad)** |
| **15:30 – 16:00** | INVITED TALK-15: Development of hybrid quantum devices using color defects in diamond.<br>**Prof. Kasturi Saha (IIT Bombay)** |
| **16:00 – 16:15** | QOP-03: Realizing Unitary Operations on High-Dimensional Graphs.<br>**Dr. Syamsundar De (IIT Kharagpur)** |
| **16:15 – 16:30** | QOP-04: Enhanced Spatial Superresolution Using Engineered Spatial Modes.<br>**Jerin A Thachil (IIST, Thiruvananthapuram)** |
| **SESSION 3B: FIBER APPLICATIONS AND OPTICAL SENSORS-2** | **Venue: Seminar Hall A** |
| **15:00 – 15:30** | INVITED TALK-16: Frontiers in Fiber Photonics Systems: Modal Interferometric to Hybrid Quantum Structures<br>**Prof. Rajan Jha (IIT Bhubaneswar)** |
| **15:30 – 16:00** | INVITED TALK-17: Tunable thin film coatings for dynamic color generation and biosensing.<br>**Dr. Sreekanth K. V (ASTAR Singapore)** |
| **16:00 – 16:15** | FOS-05: Analysis of Ring Core Hollow Photonic Crystal Fiber Based on Chalcogenide Glass for Transmission of Orbital Angular Momentum Modes in the Near-Infrared Region.<br>**Ishani De (IIT Roorkee)** |
| **16:15 – 16:30** | FOS-06: Load Estimation of Aircraft Landing Gears Using Fiber Bragg Grating Sensors.<br>**Jineesh Thomas (HAL, India)** |
| **SESSION 3C: BIOPHOTONICS AND BIOIMAGING-2** | **Venue: Seminar Hall B** |
| **15:00 – 15:30** | INVITED TALK-18: Fourier Transform Infrared (FTIR) Micro-spectroscopy as a versatile tool for early detection of diseases.<br>**Prof. Basudev Lahiri (IIT Kharagpur)** |
| **15:30 – 15:45** | BB-03: Reflectance Imaging with Double Clad Fiber Coupler and Micro-Optics for Confocal Endoscopy.<br>**Susan Thomas (IIT Madras)** |
| **15:45 – 16:00** | BB-04: 2D Photonic Crystal for the Detection of Infectious Virus and Bacterial Diseases.<br>**Ibrar Jahan M A (RNSIT, India)** |
| **16:00 – 16:15** | BB-05: An On-Chip Holography-Based Phase Contrast Microscope.<br>**Ekta Prajapati (IIT Hyderabad)** |
| **16:15 – 16:30** | BB-06: Polarization Dependent Quantitative Phase Imaging Using Transport of Intensity Equation.<br>**Himanshu Joshi (IIT Delhi)** |
| **SESSION 3D: NONLINEAR AND ULTRAFAST PHOTONICS-1** | **Venue: Seminar Hall C** |
| **15:00 – 15:30** | INVITED TALK-19: Ultrafast Structural Dynamics in Molecular Adducts Featuring Photo-initiated Proton-coupled Electron Transfer.<br>**Prof. Y Adithya Lakshmanna (IISER Thiruvanthapuram)** |
| **15:30 – 16:00** | INVITED TALK-20: Self-induced Transparency in a Semiconductor Quantum Dot medium at ultra-cold temperatures.<br>**Prof. Tarak Nath Dey (IIT Guwahati)** |
| **16:00 – 16:15** | NUP-01: Experimental Observation of Raman Peaks at Low Power in A Short Length Cascaded Fiber System<br>**Rudranil Chowdhury (IIT Kharagpur)** |
| **16:15 - 16:30** | NUP-02: Study of Self-Defocusing in Binary Mixtures of Dioxane with Homologous Alcohols Using z-Scan Technique<br>**Rahul Kumar Gupta (Munger University)** |

| SESSION-4 | 6th July '23, Time: 16:50-18:20 |
|---|---|
| **SESSION 4A: NANOPHOTONICS-2** | **Venue: J.N Tata Main Auditorium** |
| **16:50 – 17:20** | INVITED TALK-21: Reconstructive Spectrometer using Photonic Crystal Cavity<br>**Prof. Shilpi Gupta (IIT Kanpur)** |
| **17:20 – 17:35** | NP-04: Fast and Slow Light with Bound States in Continuum. **Ghanasyam Remesh (TIFR, Mumbai)** |
| **17:35 – 17:50** | NP-05: Metasurface: Miniaturising Optics in the Palm of Your Hand. **Debdatta Ray (IISER Kolkata)** |
| **17:50 – 18:05** | NP-06: Simultaneous Observation of Forward and Inverse Spin-Hall Effects in a Hybridised Plasmonic Crystal<br>**Jeeban Kumar Nayak (IISER Kolkata)** |
| **18:05 – 18:20** | NP-07: Giant Goos-Hänchen Shift Mediated by Bound States in Continuum. **Ghanasyam Remesh (TIFR, Mumbai)** |
| **SESSION 4B: SPECIAL TOPICS IN PHOTONICS-2** | **Venue: Seminar Hall A** |
| **16:50 – 17:20** | INVITED TALK-22: 'Spinstruck' particles in optical tweezers: from photonic wheels to planetary motion<br>**Prof. Ayan Banerjee (IISER Kolkata)** |
| **17:20 – 17:35** | STP-03: High-Power Orbital Angular Momentum Modes Obtained by Phase-Locking Lasers in a 1D Ring Array<br>**Vasu Dev (IIT Ropar)** |
| **17:35 – 17:50** | STP-04: Non-Hermitian Phase Transition in All-Dielectric Apodized One -Dimensional Photonic Crystals<br>**Shailja Sharma (NISER Bhubaneshwar)** |
| **17:50 – 18:05** | STP-05: Gyrotropic Confinement in Gyromagnetic Medium-Encased Dielectric Structures<br>**Rajarshi Sen (IIT Kharagpur)** |
| **18:05 – 18:20** | STP-06: Emulating Semi-Metallic, Dielectric, and Metallic Optical Interactions in Integrated Photonics<br>**Aneesh Dash (IISc)** |
| **SESSION 4C: ISOI-PHOTONICS SESSION on OPTICAL METROLOGY, INSTRUMENTATION and OPTOFLUIDICS-1,** | **Venue: Seminar Hall B** |
| **16:50 – 17:20** | INVITED TALK-23: Optical microscopy beyond diffraction limit through structured illumination.<br>**Prof. Joby Joseph (IIT Delhi)** |
| **17:20 – 17:35** | OMIO-01: Effect of Speckle Size in Edge Point Referencing for Deformation Measurement<br>**Surya Kumar Gautam (Nation Physical laboratory)** |
| **17:35 – 17:50** | OMIO-02: Simulation of Coherence Vortices from Spatially Incoherent Sources of Distinct Wavelengths<br>**Haneen V N (IIST)** |
| **17:50 – 18:05** | OMIO-03: Long Range Tunable Talbot Length for Sensing Periodicity and Wavelength<br>**Saumya Jyoti Sarkar (PRL Ahmedabad)** |
| **18:05 – 18:20** | OMIO-04: Estimation of Profile for a Tilted Surface Starting with Locally Unambiguous and Globally Wrapped Phases Synthesized Using Tunable Wavelength Laser. **Harikrishnan P (IIST)** |
| **SESSION 4D: OPTOELCTRONICS-1** | **Venue: Seminar Hall C** |
| **16:50 – 17:20** | INVITED TALK-24: Exploring the B-Exciton-Trion Dynamics in Monolayer Transition Metal DiChalcogenides<br>**Dr. Krishna Bharadwaj Balasubramanian (IIT Delhi)** |
| **17:20 – 17:35** | OE-01: Compact High-Power Heat-Pipe Cooled Led Light Fixtures for Radioactive Environments<br>**Bhanu Prakash (IGCAR Kalpakkam)** |
| **17:35 – 17:50** | OE-02: Enhanced Luminescence of CdxZn1-xSe/CdS Quantum Dot-Silver Nanoparticle Heterostructures<br>**Palash Kusum Das (IISc)** |
| **17:50 – 18:05** | OE-03: 5 nm Al0.65Ga0.35N/GaN/Al0.65Ga0.35N Hole Source Layer to Improve the Performance of the AlGaN-Based UV-C LED at Higher Current Density. **Balkrishna Choubey (IIT Jammu)** |
| **18:05 – 18:20** | OE-04: Guided-Mode Resonance Based Polarization-Insensitive Metasurface for Electro-Optic Modulation<br>**Tanmay Bhowmik (IIT Guwahati)** |

| Time/Day | DAY-3: 7th July '23, Friday | | | |
|---|---|---|---|---|
| 9:00-10:30 | J.N Tata main auditorium | Seminar Hall A | Seminar Hall B | Seminar Hall C |
| | **SESSION-5A** (Nanophotonics-3) | **SESSION-5B** (Fibers Applications and Optical Sensors-3) | **SESSION-5C** (Photonic integrated circuits-2) | **SESSION-5D** (Lasers and Applications-2) |
| 10:30-10:50 | **Tea/Coffee Break** | | | |
| 10:50-11:50 | **Annual HHV Lecture**<br>**PLENARY TALK–3:** The Birth of Picophotonics.<br>**Prof. Nikolay I Zheludev (University of Southampton, UK and Nanyang Technological University, Singapore)**<br>**Venue: J.N Tata Main Auditorium** | | | |
| 11:50-12:00 | **Session Break** | | | |
| 12:00-13:30 | J.N Tata main auditorium | Seminar Hall A | Seminar Hall B | Seminar Hall C |
| | **SESSION-6A** (Biophotonics and Bioimaging-3) | **SESSION-6B** (Special topics in Photonics-3) | **SESSION-6C** (Quantum optics/ photonics-3) | **SESSION-6D** (Optical Materials and Nanofabrication Techniques-1) |
| 13:30-15:00 | **LUNCH and POSTER SESSION-02 (P79-P156)** | | | |
| 15:00-17:00 | J.N Tata main auditorium | Seminar Hall A | Seminar Hall B | Seminar Hall C |
| | **SESSION-7A** (Nanophotonics-4) | **SESSION-7B** (Special topics in Photonics-4) | **SESSION-7C** (Quantum Optics/Photonics-4) | **SESSION-7D** (Nonlinear and Ultrafast photonics-2) |
| 17:00-17:20 | **Tea/Coffee Break** | | | |
| 17:20-20:00 | **INDUSTRY SESSION** **Venue: J.N Tata Main Auditorium** | | | |
| | **17:20-17:50: Talk-1:** Exploring photonic frontiers through data-driven models.<br>**Dr. Parama Pal (TCS)** | | | |
| | **17:50-18:20: Talk-2:** Cellphone lens workflow<br>**Dr. Katsumoto Ikeda (Ansys, Japan)** | | | |
| | **18:20-18:50: Talk-3:** Hind High Vacuum Technologies (**HHV**) | | | |
| | **18:50-19:00: Session Break** | | | |
| | **19:00-20:00: Panel Discussion:** Emerging Photonics Technologies in India – Jobs in Photonics in India -- Industry Perspective.<br>Moderator: Prof. Balaji Srinivasan (IIT Madras) and Ms. Smriti Sakhamuri (HHV Bangalore) | | | |
| 20:00-22:00 | **CONFERENCE BANQUET DINNER (Sponsored by Hind High Vacuum Technologies)** | | | |

| SESSION-5 | 7th July '23, Time: 9:00-10:30 |
|---|---|
| **SESSION 5A: NANOPHOTONICS-3** | **Venue: J.N Tata Main Auditorium** |
| **09:00 – 09:30** | INVITED TALK-25: Optothermal Tweezers Based on Colloidal Plasmonic Nanostructures<br>**Prof. G. V. Pavan Kumar (IISER Pune)** |
| **09:30 – 10:00** | INVITED TALK-26: Non-local, non-linear, and non-Hermitian nanophotonics<br>**Prof. Gururaj Naik (Rice University, USA)** |
| **10:00 – 10:15** | NP07: Dark Mode Excitation in Hybrid Terahertz Metacavities via Capacitive and Conductive Coupling<br>**Sukhvinder Kaur (IIT Delhi)** |
| **10:15 – 10:30** | NP08: Near-Field Measurements on Quantum Dots over a Plasmonic Quasi Crystal<br>**Rishabh Vij (TIFR Mumbai)** |
| **SESSION 5B: FIBERS APPLICATIONS AND OPTICAL SENSORS-3** | **Venue: Seminar Hall A** |
| **09:00-09:30** | INVITED TALK-27: Designs and Optimisation of Linear and Nonlinear Photonic Devices<br>**Prof. B. M. Azizur Rahman (University of London, UK)** |
| **09:30-09:45** | FOS-07: A Comparative Study on the Effect of Dispersion in Noise-Like Pulse Pumped Supercontinuum Generation<br>**Amala Jose (IIT Hyderabad)** |
| **09:45-10:00** | FOS-08: Silicon Photomultiplier (SiPM) Based Alpha & Beta Hand, Foot and Cloth Contamination Monitor<br>**Raghunath Rajan (IGCAR)** |
| **10:00-10:15** | FOS-09: Electrospun Fibers Dispersed with Emissive TADF Molecules<br>**Anaranya Ghorai (JNCASR)** |
| **10:15-10:30** | FOS-10: Vanadium Pentoxide (V2O5) Based Optical Fiber Humidity Sensor with Linear Response and High Sensitivity<br>**Manish Singh Negi (IIT Guwahati)** |
| **SESSION 5C: PHOTONIC INTEGRATED CIRCUITS-2** | **Venue: Seminar Hall B** |
| **09:00-09:30** | INVITED TALK-28: Microring resonators-a versatile platform for integrated and quantum photonics.<br>**Prof. Shailendra K. Varshney (IIT Kharagpur)** |
| **09:30-09:45** | PIC-03: An Experimental Study on Polarization Mode Dispersion Compensation Technique for a Monolithic CMOS-Integrated Silicon Photonics Transceiver. **Dr. Riddhi Nandi (Global Foundries, India)** |
| **09:45-10:00** | PIC-04: Design and Performance Characteristics of Quantum Well Infra-Red Photodetectors.<br>**Smita Srivastava (IIT Delhi)** |
| **10:00-10:15** | PIC-05: Manipulating Fano Spectrum in One-Dimensional Photonic Crystal Cavity<br>**Pratip Ghosh (IISc)** |
| **10:15-10:30** | PIC-06: An Optical Feynman Gate Using Cascaded Ti: LiNbO3 Directional Couplers<br>**Dr. Pranabendu Ganguly (IIT Kharagpur)** |
| **SESSION 5D: LASERS AND APPLICATIONS-2** | **Venue: Seminar Hall C** |
| **09:00-09:30** | INVITED TALK-29: Modal Analysis Excess Noise in Ultrafast Lasers: A Quantum-Inspired Approach<br>**Dr. Syamsundar De (IIT Kharagpur)** |
| **09:30-09:45** | LA-05: Rb D_2-Line Polarization Spectroscopy for Laser Frequency Locking<br>**Rajni Bala Upadhyay (IIT Delhi)** |
| **09:45-10:00** | LA-06: Laser Written Vanadium Dioxide Pattern with Tunable Thermal Emissivity<br>**Hemadri Bandhu (IIT Kanpur)** |
| **10:00-10:15** | LA-07: Low Intensity Noise Continuous Wave Supercontinuum Generation in Standard Telecom Optical Fibers.<br>**Raj Kumar Hudda (IISc Bengaluru)** |
| **10:15-10:30** | LA-08: Widely Tunable Visible Source Using Pulsed Cascaded Raman Fiber Laser.<br>**Abhigyan Goswami (IISc Bengaluru)** |

| **SESSION-6:** | **7th July '23, Time: 12:00-13:30** |
|---|---|
| **SESSION 6A: BIOPHOTONICS AND BIOIMAGING-3** | **Venue: J.N Tata Auditorium** |
| **12:00-12:30** | INVITED TALK-30: Noble Metal-Based Plasmonic Nanostructures: Expanding Photonics Frontiers in Biomedical Applications. **Dr. Amit Jaiswal (IIT Mandi)** |
| **12:30-12:45** | BB-07: Infrared Microspectroscopy of Oral Pre-Cancer: A Proof of Concept for the Rapid Screening and Early Detection. **Pranab Jyoti Talukdar (IIT Kharagpur)** |
| **12:45-13:00** | BB-08: Surface Wave Measurements on Tissue-Mimicking Phantoms Using Holographic Imaging. **Amandeep Singh (IIT Hyderabad)** |
| **13:00-13:15** | BB-09: Unraveling the Solvent-Specific Synergism of Rhodamine 101 Dye in Binary Solvents Using a Two-Photon Induced Fluorescence Technique. **Habib Ali (IIT Kanpur**) |
| **13:15-13:30** | BB-10: Deconvolved White Light Phase Shifting Interferometry for Sensitive and High-Resolution Phase Imaging. **Shubham Tiwari (IIT Delhi)** |
| **SESSION 6B: SPECIAL TOPICS IN PHOTONICS-3** | **Venue: Seminar Hall A** |
| **12:00-12:30** | INVITED TALK-31: On-Chip THz Silicon Topological Photonics for 6G to XG, **Prof. Ranjan Singh (NTU Singapore)** |
| **12:30-13:00** | INVITED TALK-32: Can excited state trions be brightened in doped semiconductor quantum wells using magnetic fields: A comparison with van der Waals semiconductors. **Prof. Asish Arora (IISER Pune)** |
| **13:00-13:15** | STP-07: Interband Polaritonics in Topological Insulators **Dr. Harish N S Krishnamoorthy (TIFR Hyderabad, CDPT NTU Singapore**) |
| **13:15-13:30** | STP-08: THz Characterization of Ge10Sb20Se70 Thin Film **Arun Pappachan (CUSAT Cochin**) |
| **SESSION 6C: QUANTUM OPTICS/PHOTONICS-3.** | **Venue: Seminar Hall B** |
| **12:00-12:30** | INVITED TALK-33: Gas-filled photonic crystal fibres for the generation and manipulation of sources of non-classical light. **Prof. Nikolas Joly (MPI, Erlangen, Germany)** |
| **12:30-13:00** | INVITED TALK-34: Fiber-mediated secure information exchange in the quantum world. **Prof. Bhaskar Kanseri (IIT Delhi)** |
| **13:00-13:15** | QOP-05: Plasmon Enhanced Bright and Polarized Single Photon Emission into Optical Fiber. **Dr. Muhammed Shafi (IISc Bengaluru)** |
| **13:15-13:30** | QOP-06: How a Two-Component Bose-Einstein Condensate Can 'bypass' the No-Cloning Theorem? **Prof. Shouvik Datta (IISER Pune)** |
| **SECTION 6D: OPTICAL MATERIALS AND NANOFABRICATION TECHNIQUES-1** | **Venue: Seminar Hall C** |
| **12:00-12:30** | INVITED TALK-35: Vanadium Dioxide: Synthesis to Applications **Prof. Amit Verma (IIT Kanpur)** |
| **12:30-12:45** | NMN-01: Scalable Fabrication of Non-Coalescent Liquid Metal Nanodroplet Structure on an Elastomeric Substrate for Gap-Plasmon-Based Mechanoresponsive Devices **Renu Raman Sahu (IISc Bengaluru**) |
| **12:45-13:00** | NMN-02: Electrically Controlled Optical Diffuser Using Negative Dielectric Anisotropy Liquid Crystal **Rishikesh Kushawaha (IIT Delhi)** |
| **13:00-13:15** | NMN-03: Spherulites as Nanophotonic Building Blocks. **Dr. Venkata Jayasurya Yallapragada (IIT Kanpur)** |
| **13:15-13:30** | NMN-04: Demonstration of Adaptive Infrared Camouflage Using Wafer Scale Vanadium Dioxide Thin Films on Silicon. **Ashok P (IIT Kanpur)** |

| SESSION-7: | 7th July '23, Time: 15:00-17:00 |
|---|---|
| **SESSION-7A: NANOPHOTONICS-4** | **Venue: J.N Tata Auditorium** |
| **15:00- 15:30** | INVITED TALK-36: Integrated Optical Control of Atomic Systems<br>**Dr. Amit Agarwal (NIST Colorado, USA)** |
| **15:30- 16:00** | INVITED TALK-37: Understanding plasmons in a multi-phase thin films and nanostructures: An example of Ag-Cu alloy system. **Prof. Shourya Dutta Gupta (IIT Hyderabad)** |
| **16:00-16:15** | NP-09: Broadband Faraday Rotation Enhancement in Magneto-Plasmonic Quasicrystalline Structure.<br>**Gajendra Mulay (TIFR, Mumbai)** |
| **16:15-16:30** | NP-10: Hybrid Anapole State in Hexagonal-Ring Shape All-Dielectric Metasurface.<br>**Monica Pradhan (IIT Kharagpur)** |
| **16:30:16:45** | NP-11: Investigation of the Coupling of Single Nanoantennas with Single Photon Emitters Using Super-Resolution Microscopy.<br>**Jessika Rogers (Rennselaer Polytechnic Institute, USA)** |
| **16:45-17:00** | NP-12: Emission Engineering of Colloidal Quantum Wells Coupled to Guided Mode Resonance Photonic Cavities<br>**Komal Sharma (IISc Bengaluru)** |
| **SESSION 7B: SPECIAL TOPICS IN PHOTONICS-4** | **Venue: Seminar Hall A** |
| **15:00- 15:30** | INVITED TALK-38: Measurement of Surface Chirality: SPECIAL TOPICS IN PHOTONICS-3 (STRUCTURED LIGHT)Leveraging the Spin-orbit Interaction of Light.<br>**Prof. Nirmal Viswanathan (UoH, Hyderabad)** |
| **15:30- 16:00** | INVITED TALK-39: Our Journey with Polarized Light: From Spin orbit interaction of light, Quantum weak measurements to Polarimetry.<br>**Prof. Nirmalya Ghosh (IISER Kolkata)** |
| **16:00- 16:15** | STP-09: Helicity Conversion on Tight Focusing of Circularly Polarized Inhomogeneous and Structured Beams in Optical Tweezers.<br>**Ram Nandan Kumar (IISER Kolkata)** |
| **16:15- 16:30** | STP-10: Accurate Determination of Excitonic Spectra of Monolayer Selenium - PtS2 Van der Waals Heterostructure.<br>**Anjana E Sudheer (IIIT Kurnool)** |
| **16:30: 16:45** | STP-11: Terahertz Magneto spectroscopy Study of Superlattice Plasmonic Metasurface.<br>**Nityananda Acharyya (Mahindra University, Hyderabad)** |
| **16:45- 17:00** | STP-12: On-Chip Photonics Integrated Piezo MEMS Optical 1-D Beam Scanner.<br>**Venkatachalam P (IISc Bengaluru)** |
| **SESSION 7C: QUANTUM OPTICS/PHOTONICS-4** | **Venue: Seminar Hall B** |
| **15:00- 15:30** | INVITED TALK-40: Orbital Angular momentum entanglement.<br>**Prof. Anand Kumar Jha (IIT Kanpur)** |
| **15:30- 16:00** | INVITED TALK-41: Birefringence and dichroism effects in the spin noise spectra of a spin-1 system.<br>**Prof. Fabien Bretenaker (LuMIn, CNRS-Universite Paris-Saclay, France)** |
| **16:00- 16:15** | QOP-07: Hybrid of 2D-Material and Plasmonic Nanostructures, an Excellent Material Platform for Photonic Quantum Technologies<br>**Laxmi Narayan Tripathi (VIT Vellore)** |
| **16:15- 16:30** | QOP-08: Characterization of Single Photon Detector and Its Quenching Circuit Analysis<br>**Suchismita Bose (IIT Kanpur)** |
| **16:30: 16:45** | QOP-09: Role of Exciton-Biexciton Population Distribution in Single Photon Emission Statistics of Semiconducting Colloidal Quantum Wells<br>**Amitrajit Nag (IISc Bengaluru)** |
| **16:45- 17:00** | QOP-10: Development of a Scanning Confocal Microscopy to Study Single Quantum Emitters<br>**Nitesh Singh (IIT Ropar)** |

| SESSION 7D: NONLINEAR AND ULTRAFAST PHOTONICS-2 | Venue: Seminar Hall C |
|---|---|
| **15:00- 15:30** | INVITED TALK-42: Femtosecond THz dynamics in metallic heterostructures.<br>**Dr. Sunil Kumar (IIT Delhi)** |
| **15:30- 16:00** | INVITED TALK-43: Resonant Second-Harmonic Generation as a Probe of Quantum Geometry<br>**Prof. Amit Agarwal (IIT Kanpur)** |
| **16:00- 16:15** | NUP-03: Spatial Dissipative Solitons with Topological Charges in Graphene-Based Active Random Laser Metamaterials<br>**Ashis Paul (IIT Kharagpur)** |
| **16:15- 16:30** | NUP-04: Femtosecond Mid-IR Optical Parametric Generation at 10 MHz with High Conversion Efficiency<br>**Sukeert (ICFO-The Institute of Photonics Sciences, Spain)** |
| **16:30: 16:45** | NUP-05: Discrete Soliton Interaction in Uniform Waveguide Arrays: A Continuous and Semi-Analytical Approach<br>**Anuj Pratim Lara (IIT Kharagpur)** |
| **16:45- 17:00** | NUP-06: Ultrafast Quantum Simulator Using Ultracold Rydberg Excited Atomic Mott-Insulator<br>**Vikas Singh Chauhan (Institute of Molecular Science, NINS, Japan)** |

# INDUSTRY SESSION
## 7th July '23, Time: 17:20-20:00

| | |
|---|---|
| **17:20- 17:50** | **Talk-1:** Exploring photonic frontiers through data-driven models.<br>**Dr. Parama Pal (TCS)** |
| **17:50- 18:20** | **Talk-2:** Cellphone lens workflow<br>**Dr. Katsumoto Ikeda (Ansys, Japan)** |
| **18:20- 18:50** | **Talk-3:** Hind High Vacuum Technologies (**HHV**) |
| **19:00- 20:00** | **Panel Discussion:** Emerging Photonics Technologies in India – Jobs in Photonics in India -- Industry Perspective.<br>**Session Moderators: Prof. Balaji Srinivasan (IIT Madras) and Ms. Smriti Sakhamuri (HHV Bengaluru).** |

| Time/Day | DAY-4: 8th July '23, Saturday | | | |
|---|---|---|---|---|
| 9:00-10:30 | J.N Tata main auditorium | Seminar Hall A | Seminar Hall B | Seminar Hall C |
| | **SESSION-8A** (Nanophotonics-5) | **SESSION-8B** (Lasers and Applications-3) | **SESSION-8C** (Special topics in Photonics-5) | **SESSION-8D** (Fibers and Optical Sensors-4) |
| 10:30-10:50 | **Tea/Coffee Break** | | | |
| 10:50-11:50 | **PLENARY TALK–4:** Semiconductor Quantum Dots: From Trap-States to Single Photon Purity and Charge Stabilization**.**<br>**Prof. K. George Thomas (Indian Institute of Science Education and Research Thiruvananthapuram, India)**<br>**Venue: J.N Tata Main Auditorium** | | | |
| 11:50-12:00 | **Session Break** | | | |
| 12:00-13:30 | J.N Tata main auditorium | Seminar Hall A | Seminar Hall B | Seminar Hall C |
| | **SESSION-9A** (Nanophotonics-6) | **SESSION-9B** (Optical metrology, Instrumentation/optofluidics-2) | **SESSION-9C** (Optical communication and networks-2) | **SESSION-9D** (Fibers and Optical Sensors-5) |
| 13:30-15:00 | **LUNCH and POSTER SESSION-03 (P157-P241)** | | | |
| 15:00-15:30 | **SPECIAL SESSION by Instrument Society of India (ISOI)**<br>Venue: J.N Tata main auditorium | | | |
| | **15:00-15:30: ISOI SPECIAL LECTURE by Prof. Rajpal S. Sirohi**<br>My lifetime contributions in Optical Metrology | | | |
| 15:30-16:30 | **ISOI Contributed Talks** | | | |
| 16:30-16:40 | **Tea/Coffee Break** | | | |
| 16:40-17:30 | **CONFERENCE CLOSING CEREMONY** | | | |
| 17:30-19:00 | **Special Discussion Session: Scientific Journals and Publications in India** | | | |
| 19:00-21:00 | **DINNER** | | | |

| SESSION-8: | 8th July '23, Time: 9:00-10:30 |
|---|---|
| **SESSION 8A: NANOPHOTONICS- 5** | **Venue: J.N Tata Main Auditorium** |
| **09:00 – 09:30** | INVITED TALK-44: Study of Magneto-optical Effects for Nanophotonic Applications<br>**Prof. Ranjani Viswanatha (JNCASR Bengaluru)** |
| **09:30 – 10:00** | INVITED TALK-45: Planar Optics for Applications Spanning Microwave to Visible Range Wavelengths<br>**Prof. R. Vijaya (IIT Kanpur)** |
| **10:00 – 10:15** | NP-13: White Upconversion Luminescence of Nd3+ -Yb3+ Ions Pair Co-Doped Ex-Situ Sol-Gel Derived Zinc-Silicate Dense Glass. **Mrigankadeep Bharadwaj (Mizoram University)** |
| **10:15 – 10:30** | NP-14: Generation of Optical Needle Through Sliced-Pizza Scheme Metalens.<br>**U Abinash Patro (IISER Berhampur)** |
| **SESSION 8B: LASERS AND APPLICATIONS-3** | **Venue: Seminar Hall A** |
| **09:00 – 09:15** | LA-09: Geometric-Phase Induced Optimum Output Coupling in Optical Parametric Oscillators<br>**Chahat Kaushik (PRL Ahmedabad)** |
| **09:15 – 09:30** | LA-10: Mid-Infrared Quantum Cascade Laser-Based Wavelength Modulation Spectroscopy for the Detection of Greenhouse Gases and NOx. **Shruti De (IIT Gandhinagar)** |
| **09:30 – 09:45** | LA-11: Experimental Investigation on Linewidth Evolution of Cascaded Raman Fiber Laser Pumped with Low Intensity Fiber Amplifiers<br>**Rashmita Deheri (IISc, Bengaluru)** |
| **09:45 – 10:00** | LA-12: Spectral Beam Combining of Narrow-Linewidth Lasers from a Phase Modulated Frequency Comb-Based Seed Source. **Shilpi Arora (IISc, Bengaluru)** |
| **SESSION 8C: SPECIAL TOPICS IN PHOTONICS-5** | **Venue: Seminar Hall B** |
| **09:00 –09:30** | INVITED TALK-46: Terahertz (THz) Spectroscopy Applied to the study of Materials.<br>**Prof. Sriganesh Prabhu (TIFR Mumbai)** |
| **09:30 – 10:00** | INVITED TALK-47: Toroidal resonances in terahertz meta-surfaces.<br>**Prof. Gagan Kumar (IIT Guwahati)** |
| **10:00 – 10:15** | STP – 13: Simplified Terahertz Wideband Metamaterial Absorber<br>**Nikhil Dey (IIT Delhi)** |
| **10:15 – 10:30** | STP – 14: Mid-Infrared Polarization Rotation Based on 2D Van der Waals Natural Hyperbolic Materials<br>**Nihar Ranjan Sahoo (IIT Bombay)** |
| **SESSION 8D: FIBERS AND OPTICAL SENSORS-4** | **Venue: Seminar Hall C** |
| **09:00 – 09:15** | FOS – 11: Analysis of Blast Wave Impact on FBG Sensor Response Inside Shock Tube<br>**Gautam Hegde (IISc, Bengaluru)** |
| **09:15 – 09:30** | FOS – 12: Influence of Double-Nested Tubes on Avoided Crossings in 5-Tube Nested Hollow-Core Fibers<br>**Archana Kaushalram (IISc, Bengaluru)** |
| **09:30 – 09:45** | FOS – 13: Experimental Investigation of SBS in Dispersion Oscillating Fiber<br>**Mrudula Krishna (IIT Madras)** |
| **09:45 – 10:00** | FOS – 14: Investigating Sensing Performance of Gaussian Apodized Fiber Bragg Gratings with Linearly Tapered Profile<br>**Souryadipta Maiti (Banaras Hindu University)** |
| **10:00 – 10:15** | FOS – 15: Homogeneous Vortex Solutions in Nonlinear Multicore Fiber with and Without Polarization Cross-Coupling<br>**Shamaem Khushhali (IIT Kharagpur)** |
| **10:15 – 10:30** | FOS – 16: Guided Mode Excitation Based All-Dielectric High Contrast Grating Sensor for Visible Region<br>**Swapnil Khurana (IIT Roorkee)** |

| SESSION-9: | 8th July '23, Time: 12:00-13:30 |
|---|---|
| **SESSION 9A: NANOPHOTONICS – 6** | **Venue: J.N Tata Auditorium** |
| **12:00 – 12:30** | INVITED TALK-48: Magnetically controlled terahertz superlattice metasurfaces.<br>**Prof. Dibakar R Choudhuri (Mahindra University, Hyderabad)** |
| **12:30 – 12:45** | NP-15: Dynamical Beam Steering Based on 1-Bit Reconfigurable Intelligent Surface<br>**Jaganbharathi Krishnan Ramalingam (VIT Vellore)** |
| **12:45 – 13:00** | NP-16: Excitation of Evanescent Orders by Employing Metallic Metagrating<br>**Shreeya Hemant Rane (Mahindra University, Hyderabad)** |
| **13:00 – 13:15** | NP-17: Numerical Investigation of Dual-Band Metamaterial Absorber<br>**Nikita Choudhary (IIT Roorkee)** |
| **13:15 – 13:30** | NP-18: Plasmonic Cavity Enhanced Raman Scattering of Single Walled Carbon Nanotubes<br>**Lekshmi J (University of Mumbai)** |
| **SESSION 9B: ISOI-PHOTONICS SESSION on OPTICAL METROLOGY, INSTRUMENTATION and OPTOFLUIDICS-2** | **Venue: Seminar Hall A** |
| **12:00-12:30** | INVITED TALK-49: High-Performance Optical Spectroscopy (HPOS) Technology<br>**Prof. Sai Siva Gorthi (IISc)** |
| **12:30-12:45** | OMIO-05: Tunable Spiral Vector Vortex Beams Using A Mach-Zehnder Interferometer<br>**Hari Krishna Chowduri (IIT Kharagpur)** |
| **12:45-13:00** | OMIO-06: Evaluation of Concave, Oblate Ellipsoidal, Off-Axis Segmented Mirror: Critical Aspects of Testing and Characterization. **BS Bhargava Ram (IIT Delhi)** |
| **13:00-13:15** | OMIO-07: Lineshape Engineering of Whispering Gallery Modes Using a Photonic Molecule<br>**Tulika Agrawal (IIT Madras)** |
| **13:15-13:30** | OMIO-08: Thermoplasmonically Controlled Binary Colloidal Assembly<br>**Chetteente Meethal Ragisha (NIT Calicut)** |
| **SESSION 9C: OPTICAL COMMUNICATION AND NETWORKS-2** | **Venue: Seminar Hall B** |
| **12:00-12:15** | OCN-05: Comparison of Communication and Optical Properties of Red, Yellow and Green Phosphor Using Blue Led Excitation. **Aayushi Soni (IIT Delhi)** |
| **12:15-12:30** | OCN-06: Photonic Generation of Nonlinear 13-Bit Barker-Coded Frequency Modulated Radar Waveforms<br>**Rajveer Dhawan (IIT Delhi)** |
| **12:30-12:45** | OCN-07: Four Core Fiber for Data Center Applications<br>**Srinivas Munige (Sterlite Technologies Ltd.)** |
| **12:45-13:00** | OCN-08: Restricted Boltzmann Machine-Based Nonlinear Equalizer for DP-16QAM Coherent Optical Communication Systems. **Naveenta Gautam (IIT Delhi)** |
| **13:00-13:15** | OCN-09: Generation of QPSK Modulated Data in X-Band Using Optical Phase Locked Loop<br>**Bhooma G (IIT Madras)** |
| **13:15-13:30** | OCN-10: High-Extinction Electromagnetically Induced Transparency-Like RF Filters Using Brillouin Scattering<br>**Reena Parihar (IIT Delhi)** |
| **SESSION 9D: FIBERS AND OPTICAL SENSORS-5** | **Venue: Seminar Hall C** |
| **12:00-12:15** | FOS-17: Ultrawide Wavelength Tunability Using Lesser Grating Periods in Optical Nanowire<br>**Subrat Sahu (IIT Bhubaneswar)** |
| **12:15-12:30** | FOS-18: Selective Detection of Melamine Using Misaligned Fiber Interferometer<br>**Pintu Gorai (IIT Bhubaneswar)** |
| **12:30-12:45** | FOS-19: Detection of Ethanol Vapor Using Metal-Organic Frameworks as an Adsorbent Using Fibre Optics<br>**Shilpa N Kulkarni (RCOEM Nagpur)** |

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| **12:45-13:00** | FOS-20: Study of Raman Gain Coefficients of ITU-T Single-Mode Fiber Types<br>**Annesha Maity (Sterlite Technologies)** |
| **13:00-13:15** | FOS-21: Study of Optical Fiber Failure Under High Power and Bend Conditions<br>**Annesha Maity (Sterlite Technologies)** |
| **13:15-13:30** | FOS-22: Highly Sensitive Biochemical Sensor Based on Nanophotonic Ring Resonator.<br>**Santhosh Kumar (IIT Indore)** |

## SPECIAL SESSION by Instrument Society of India (ISOI)

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|---|---|
| **15:00-15:30** | **15:00-15:30: ISOI SPECIAL LECTURE by PROF. RAJPAL S. SIROHI**<br>My lifetime contributions in Optical Metrology<br>**Venue: J.N Tata Main Auditorium** |
| **15:30-15:40** | ISOI-01: Silicon Photo Multiplier (SiPM) Based Photon Detection System for Nuclear Radiation Detection and Measurement |
| **15:40-15:50** | ISOI-02: Methane Gas Biosensor Using Mach-Zehnder Interferometer |
| **15:50-16:00** | ISOI-03: Laser Triangulation Based Profilometer to Measure the Warpage During Fabrication |
| **16:00-16:10** | ISOI-04: Developing Advanced Materials for Stealth Technology via Photoelastic Analysis of Vibration and Refractive Index |
| **16:10-16:20** | ISOI:05: Workload estimation in exercise Magnetocardiogram using photoplethysmography |
| **16:20-16:30** | ISOI-06: Analyzing the Impact of External Environment on Quantum Coherence Through the Wigner Approach |

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| **16:40-17:30** | **CONFERENCE CLOSING CEREMONY and PRIZE/CERTIFICATE DISTRIBUTION** |

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|---|---|
| **17:30-19:00** | **Special Discussion Session: Scientific Journals and Publications in India** |

# POSTER PRESENTATION SCHEDULE:

## POSTER SESSION-01: 6th July '23, Thursday. Time: 13:30-15:00

| Slot | Poster Title |
|---|---|
| P01 | Novel Optogenetic Method for Low-Power High-Fidelity Sustained Neural Spiking |
| P02 | Optical Suppression of Tachyarrhythmia in Human Heart with Potassium Selective Channelrhodopsin |
| P03 | Pollen Imaging Using Digital Holographic Microscopy |
| P04 | Blood Sample Analysis Using Bio-Photonic Sensor with 1D Defect Layer Photonic Crystal |
| P05 | Towards LED Calibration and Testing for Narrowband Multispectral Imaging Modality |
| P06 | Machine-Learning-Guided Gram Type Identification of Bacterial Infections Using Autofluorescence Signatures |
| P07 | Twin-Image Free Lensless Holographic Microscopy Reconstructions Based on Compressive Sensing |
| P08 | Label Free Multimodal Nonlinear Optical Microscopy for Investigating Biomacromolecules |
| P09 | Impact of Acoustic Vibrations for Weight Classification on the Plastic Optical Fiber Assisted by Machine Learning |
| P10 | Multimode Interference Based Fiber Optic Refractive Index Sensor with Augmented Sensing Characteristics |
| P11 | Novel Fiber Bragg Grating Based Tilt Sensor Employing Effective Refractive Index Modulation Mechanism |
| P12 | Investigations of Bright Optical and Other Soliton Solutions of (1+1)-Dimensional Resonant Nonlinear Schrödinger Equation Arising in Optical Fibers |
| P13 | Photothermally Mediated Long-Range Fluidic Control |
| P14 | Arched Fiber Interferometry Based Wearable System for Health Monitoring |
| P15 | Implementing Electro-Optically Tunable General-Purpose Photonic Processors |
| P16 | Electrically Controlled Dispersion Characteristics in Silicon Nitride Waveguide |
| P17 | Biospeckle Activity Assessment of Shelf-Life Storage of Chicken Eggs |
| P18 | S + C Band Optical Amplification via Cascaded Thulium-Erbium Doped Fiber |
| P19 | Optical Vortex Lattice Based Image Encoding |
| P20 | Synthesis and Non-Linear Optical Characterization of the Novel Schiff Base Derivative |
| P21 | Clean Synthesis and Characterization of Copper Nanoparticles in Deionized Water by Pulsed Laser Ablation |
| P22 | Stand off Fabrication of Heat Resistive Superhydrophilic Silicon Using NdYAG Laser |
| P23 | Secure Optical Communication Using Multimode Semiconductor Diode Lasers |
| P24 | Investigation of a Highly-Sensitive Aluminum-Based Plasmonic Device Using Antimonene for Sensing Applications |
| P25 | Analytical Model for Quantifying and Optimizing the Thermoplasmonic Response of Gold Nanocomposite |
| P26 | Highly Sensitive Graphene-Based Refractive Index Sensors Using Plasmonic Nanoantennas |
| P27 | Observation of Frequency Gap in Photonic Structures with Tailored Disorder |
| P28 | Self-Referencing 1D Meta-Grating Refractive Index Sensor with Enhanced Performance in near Infrared Region |
| P29 | Modulating Dispersion of Surface Plasmon Modes of Circular Cylindrical Three Layer Graphene Waveguide Using Graphene Conductivity |
| P30 | Plasmonic Metasurface Mimicking the Top Surface of Colloidal Photonic Crystal |
| P31 | Magnetic Field Mended SERS Based Hemozoin Detection for Early Malaria Diagnosis |
| P32 | Amplified Coherent Plasmon Mode in Presence of Phonon |
| P33 | Design and Simulation of a Narrow Band-Pass Filter Using a Planar Dielectric Metasurface |
| P34 | Effect of Lattice Disorder on Photo-Sensing Properties of Ga-Doped ZnO |
| P35 | Purcell Enhancement of a Quantum Emitter in the Influence of a Plasmonic Cavity |
| P36 | Nonlinear Optical Properties of Two Dimensional (2D) Transition Metal Dichalcogenides (PdTe2 and Pd2S4) - A Comparative Study |
| P37 | Gap Solitons in Photorefractive Crystals with Apodized Photonic Lattices |
| P38 | Diffraction - Noise Experiment with Quasi Phase Matching Device for Electric Poling Quality Evaluation |
| P39 | Linear and Nonlinear Optical Properties of Lithium Tantalate Thin Film Fabricated by PLD Technique |
| P40 | Performance Analysis of Pulse Compression in Self-Similarly Designed Yb-Doped Silica Photonic Crystal Fiber for Biomedical Applications |

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| **P41** | Numerical Investigation of Medium Dependent Thermo-Optic Nonlinear Effects for High Repetition Rate Fs Oscillators |
| **P42** | Symmetric Radiation from Pure Dark Soliton |
| **P43** | Synthesis of MoS2 Nanoflakes by Ultrasonication Induced Liquid-Phase Exfoliation |
| **P44** | Comparative Analysis of Thin Film Photovoltaic Performance Parameters Using Different Back Surface Reflectors |
| **P45** | Polariton-Assisted Quantum State Modification of A TADF Molecule Inside an Organic Disordered Photonic Structured Matrix |
| **P46** | Soliton Propagation in Fused Silica Optical Fiber |
| **P47** | Performance of Bit Error Rate (BER) in OOk Modulation Using Orbital Angular Momentum (OAM) Carrying Gaussian Vortex Beam |
| **P48** | Compensation of Dispersion Induced Degradation in Interference Based Microwave Photonic Notch Filter |
| **P49** | 80 Tb/s Transmission over 50 km 4C-MCF in Un-Amplified Optical Network |
| **P50** | Role of Gaussian Fitting in the Image Reconstruction in a STORM Based Super-Resolution Microscope |
| **P51** | Quality Guided Phase Unwrapping Algorithm Based on Breadth-First-Search |
| **P52** | Investigation of Phase Nonlinearity Through Computer-Generated Fourier Transform Hologram |
| **P53** | Broadband Supercontinuum Laser-Based Sensing of Methane Using Hollow Core Waveguide |
| **P54** | Performance Analysis of Image Sensor Based Random Number Generators |
| **P55** | Instrumentation for Vein Visualization and Depth Estimation: A Novel Calibration Method |
| **P56** | Hollow Core Fiber and Quartz Enhanced Photoacoustic Spectroscopy Techniques for Measurement of Carbon Dioxide with a Supercontinuum Laser Source |
| **P57** | Study of the Influence of Straight-Edge Material on Boundary Diffraction Wave Using the Diffraction Lloyd Mirror Interferometer |
| **P58** | Set Up Calibration and Spectral Resolution in a New Fabricated Raman Spectrograph |
| **P59** | Surface Potential Measurement and Wave-Guide Properties of Quasi-1-D SnO⁻2 |
| **P60** | Optimization of Lead-Free Bismuth Halide Perovskite Solar Cell Simulation Using SCAPS-1D |
| **P61** | Photoresponse of Multi-Walled Carbon Nanotube/Si-Based Photodetector |
| **P62** | Facile Synthesis and Characterization of gC3N4/ZrO2 Nanocomposite with Different pH of ZrO2 Nanoparticle for Emissive Material in OLED Applications |
| **P63** | Wideband Uniform-Efficiency OAM Detector for Any General Photonic State |
| **P64** | Dynamics of Optical Solitons in MCQWs Under the Influence of Strong Kerr and Quintic Nonlinearities |
| **P66** | Large Optical Nonlinearity Due to Intersubband Transition in Three Coupled Quantum Wells |
| **P67** | Intra-Atomic Frequency-Comb-Based Photonic Quantum Memory Using Single-Atom-Cavity Setup |
| **P68** | Spectrally-Pure Visible-Telecom Photon Pairs via SiN Waveguide |
| **P69** | Tunable Frequency-Entangled Photon-Pair Generation in Telecom Band via Cascaded X(2) Process |
| **P70** | Nonlinear Frequency Conversion of Airy and Bessel Beams via Four-Wave Mixing in Rubidium Vapor |
| **P71** | Quantum Non-Gaussianity of Number States Filtered Coherent State |
| **P72** | Autofocusing and Self-Healing of Circular Airy Derivative Beams |
| **P73** | Exceptional Point Based Synchronization Between Two Optomechanical Combs |
| **P74** | Quantum Phase Synchronization in Dual Optomechanical Cavity System |
| **P75** | 1D Speckle-Learned OAM Demultiplexing in Free Space Optical Communication |
| **P76** | Electromagnetically Induced Transparency in Broadside Coupled Toroidal Terahertz Metasurfaces |
| **P77** | Astigmatic Transformed Far-Field Speckle-Learned Classification of Intensity Degenerate Orbital Angular Momentum Modes |
| **P78** | Speckle-Learned Information Demultiplexing Using Hermite Gaussian Superposition Modes |
| **P241** | Optical Characterization of a Compact Carrier Injection-Based Silicon PIN Modulator |
| **P203** | Designing a Dual-Pump Fiber Phase Sensitive Amplifier with a Dispersion Oscillating Fiber |

# POSTER SESSION-02: 7th July '23, Friday. Time: 13:30-15:00

| Slot | Poster Title |
|---|---|
| P79 | Synthesis of Green-Fluorescent Carbon Nanoparticles from Catharanthus Roseus |
| P80 | Green Synthesis Derived Carbon Nanoparticles from Syzygium Cumini and Ocimum Tenuiflorum |
| P81 | Wavefront Shaping with Regularized Cost Function for Advancing Structure Light Through Turbid Media |
| P82 | Plasmon and Phonon Polaritons Based Simultaneous Detection in near and Mid-IR |
| P83 | Analysis of FBG Based Temperature Sensor with Metallic and Polymeric Coatings for Enhanced Thermal Sensitivity |
| P84 | Optical Fluence Compensation from Reconstructed Photoacoustic Images Using Deep Learning Model |
| P85 | Microscope Position-Based Image Stitching Using Template Matching for an Unaligned Stage |
| P86 | Automated Diagnosis of Diffuse Large B-Cell Lymphoma |
| P87 | Machine Learning Techniques for Impact Monitoring and Localization on Metallic Plates Using Fiber Bragg Grating Sensors |
| P88 | Tin Disulfide-Coated Non-Adiabatic Tapered Fiber for Humidity Sensing |
| P89 | Analysis of Fiber Bragg Grating Sensor for CFRP Beam Crack Growth |
| P90 | A Simple Side Polished Photonic Crystal Fiber Based SPR Sensor |
| P91 | Fibre Bragg Grating (FBG) Sensor Based Discrete Level Measurement in Reactor Applications |
| P92 | Integrated Modal and Cavity Interferometer for Ultrasensitive Magnetometry |
| P93 | Mode Dependency of Surface Plasmon Wave in Fiber Optic SPR Sensor |
| P94 | Wavefront Shaping for Enhanced Branched Flow in a Disordered Photonic Lattice |
| P95 | A New Boundary Condition for Suppression of Numerical Reflections |
| P96 | A New Method for Obtaining Loss in Leaky Fiber Structures |
| P97 | Mapping the Spatial Correlation Length of the Modes of Random Lasers |
| P98 | Gain Conditions for Stable Dual-Wavelength Generation Using a Birefringent Buried Heterostructure Laser |
| P99 | High-Speed Image Acquisition of Holographically Controlled Trapped Microscopic Bead |
| P100 | Manipulating Motion of Split Optical Vortices Using Binary Fork Grating |
| P101 | Spot Size Sensitivity and Choice of Lens Focal Length |
| P102 | Effect of Feedback Strength on Lasing Efficiency and Threshold Current of an Incoherently Fed Back Semiconductor Diode Laser |
| P103 | Correlation Between Photoluminescence and Raman Spectroscopy with Localized Surface Plasmon Resonance of Silver Nanoparticles Grown by Solid State Dewetting Technique |
| P104 | Highly Sensitive Biochemical Sensor Based on Nanophotonic Ring Resonator |
| P105 | Long-Range Dipole-Dipole Interactions Between Nano-Antennas Embedded in Hyperbolic Metamaterials |
| P106 | Surface Plasmon Resonance-Based Refractive Index Sensor for Cancerous Tissue Detection |
| P107 | Design and Simulation of Compact Plasmonic IR Sensor for High-Sensitivity Detection of RI Changes |
| P108 | Broadband and Tunable Linear-To-Circular Polarization Converter Using Graphene Based Metasurface |
| P109 | Polarization-Independent Hybrid Bound States in Continuum in All-Dielectric Metasurfaces |
| P111 | Simulation Study of A One Dimensional All Metal Narrow Band Plasmonic Metasurface Asborber in Visible Wavelength Range |
| P112 | Label-Free SERS Detection of Uric Acid Using Silver Functionalized TiO2 Nanorods Based SERS Substrates |
| P113 | Ultrabroadband Plasmonic Meta-Absorber Using Hybrid Split Ring Nanostructures |
| P114 | Geometry-Dependent Terahertz Studies on Plasmonic Dipole Cavities |
| P115 | Inverse Design of Metalens from Phase Data Using a Modified VAE Based Predictor |
| P116 | Engineering Axial Intensity of Bessel Beams Using Meta-Axicons with Amplitude and Phase Control |
| P117 | Femtosecond LaserDirect Writing of All-Dielectric, Dispersive Nanostructure |
| P118 | Omnidirectional Reflector Using One Dimensional Photonic Heterostructure |
| P120 | Tunable Frequency Comb in the Deep UV Region Using Raman Induced Self-Frequency Shift and Cascading of Optical Nonlinearities |
| P121 | Ab-Initio Simulation of Laser-Induced Electron Dynamics of Semiconductors: The Case of TiO |
| P122 | Modulation Instability in a PT-Symmetric Twin Core Fiber with Saturable Kerr Nonlinear Response |

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| **P123** | The Role of Mg-Doping in Tuning the Band Gap and Third-Order Non-Linear Optical Properties of ZnO Nanostructures for NLO Device Applications |
| **P125** | A Holographic Approach Using Dichromated Gelatin for Producing Structural Colour Filters |
| **P126** | Terahertz Dielectric and Optical Properties of Barium Hexaferrite |
| **P127** | Four Core Optical Fiber with Low Cross Talk |
| **P128** | Microbend Optimized Reduced Diameter Optical Fiber |
| **P129** | An All-Fiber MMI Optical Switch Based on Square Core Multimode Fiber |
| **P130** | A Novel EDFA Transient Mitigation Method for LVDS Communication over WDM Links |
| **P131** | Sensitivity of Hong-Ou-Mandel Interference of Two Diverging Beams |
| **P132** | Quantitative Evaluation of Point Cloud Based Algorithm for CGH Generation with Variable Phase Masks |
| **P133** | Somatic Cancer Cell Detection Using Silicon Photonics Micro Ring Resonator |
| **P134** | Common Path Technique for Tunable Geometric Phase Optical Elements |
| **P135** | Low-Coherence Profilometry of Reflective Surface Using Differential Interference Microscopy in a Sagnac Setup |
| **P136** | Effect of Birefringence on Scattered Spatial-Polarization Entangled Beam |
| **P137** | Design of an Electrothermally Actuated MEMS Mirror for a Two Photon Fluorescence Micro-Endoscope |
| **P138** | Optoelectronic Properties of Hydrothermal Synthesized Cesium Nickel Chloride |
| **P139** | 2D Material Molybdenum DiSulphide Role in Energy Generation-A Review |
| **P140** | Optical Waveguide Based Next Generation Head Up Display (HUD) for Avionics |
| **P141** | Effect of Cd-Doping on Linear and Non-Linear Properties of Nanostructured Zn1-xCdxS Thin Films for Optoelectronic Device Applications |
| **P142** | InSb-Based Mid-IR Photodetector with Boron Nitride as Anti-Reflective Coating and Gold Nanofilm for Enhanced Responsivity |
| **P143** | Understanding the Validity of the Markovian Approximation in the Dynamics of Energy Transfer in the FMO Complex |
| **P144** | Generation of Correlated Photon Pairs Using Pulsed Pump in Type-0 PPLN Waveguide |
| **P145** | Effect of Longitudinal Magnetic Field on Zeeman EIT in Doppler Broadened Rb Vapor |
| **P146** | Generating Heralded Single Photons from TYPE-II PPKTP Crystal Using Third Order Quasi-Phase Matching |
| **P147** | Structured Near-Field Spatial Correlations in Entangled Photons |
| **P149** | Modelling of Single Photon Emission Fidelity of Nanocrystal Quantum Dots |
| **P150** | Signature of Topological Supermodes in A Specialty Periodic Tri-Lattice Optical Fiber |
| **P151** | Design and Simulation of Solid-Core Octagonal Photonic Crystal Fibre for Terahertz Wave Propagation |
| **P152** | Continuous Variable Entanglement Using Optomechanics and Squeezing |
| **P153** | Design and Control of Topological Valley Edge Modes for Terahertz Photonics |
| **P154** | Study of Optical and Dielectric Properties of Simple and Green Process-Based Synthesis Novel Fluoro-Nitrato Energetic Plasticizer Materials Using Terahertz Time-Domain Spectroscopy |
| **P155** | Modulation Characteristics of Ge2Sb2Te5 Metasurface Terahertz Switch |
| **P156** | Index Measurement of a Structured Beam Carrying Polarization Singularity Using Astigmatic Lens |

# POSTER SESSION-03: 8th July '23, Saturday. Time: 13:30-15:00

| Slot | Poster Title |
|---|---|
| P157 | Mathematical Modelling for Polarization Based Photoacoustic System to Evaluate the Changes in Propagation of Polarized Light in Tissues |
| P158 | Novel Approach Combining Terahertz and Autofluorescence Imaging for Accurate Cancer Margin Assessment in Fresh Tissue |
| P159 | Development of High-Resolution Quantitative Phase Microscope for Blood Cells Using Angular Multiplexing |
| P160 | Theoretical Analysis Based on Relative Frequency of Excitation and Depletion Beams in SSTED-SIM |
| P161 | Deep-Seated Negative Axicon Probe-Based Optical Coherence Tomography for Tumor Detection |
| P162 | Influence of Fiber Probe Geometry on Depth-Resolved Fluorescence |
| P163 | Detection of Intraerythrocytic Stages of Plasmodium Falciparum Parasite Using One-Dimensional Bragg Mirror Optical Sensor |
| P164 | Functionalized Nanomaterials for Fluorescence Sensing and Bioimaging Applications |
| P165 | Fiber Optic Modified Cladding Gd Doped Sm2O3 Coated Ethanol Gas Sensors |
| P166 | Fabrication of 3-D Printed Plunge Mechanism Type FBG Pressure Sensor for Underwater Applications |
| P167 | Enhancing Temperature Sensitivity of Fibre Bragg Gratings Using Metallic Jacket |
| P168 | SPR-Based Side Polished PCF Sensor with Gold Grating Plasmonic Layer |
| P169 | Photoelasticity-Based Development of Stealth Technology via Correlating Material Vibration and Refractive Index |
| P170 | Design of a Mode Selective Coupler for Switchable Higher-Order Mode Generation |
| P171 | Wafer-Scale Germanium and Silicon Nitride Thin Film Mid-Infrared Filter |
| P172 | An Ultra Compact Mode Demultiplexer by Inverse Method |
| P173 | Design Optimization in Compact Mode-Division-Multiplexer for Multi-Channel Optical Interconnects |
| P174 | Detection of Ammonium Nitrate in Mixtures Using Raman Spectroscopy and Machine Learning |
| P175 | Laser-Induced Graphene Foam-Based Broadband Perfect Absorber |
| P176 | Measurement of Water Vapor in Near-Infrared Regime Mixed with Liquid Using Wavelet Transform |
| P177 | Self Q-Switched Laser Pumped Supercontinuum for Non-Contact Thermal Measurement of Si Wafer |
| P178 | Modeling of Track Height Generation in LDED Using Neural Network |
| P179 | Modes of a Fabry-Pérot Resonator with Random Grating Induced Feedback |
| P180 | Near IR Emission Enhancement of Color Center Embedded in Silicon Carbide Pillars Meta-Surface |
| P181 | Understanding Chiral Detection Using Chiral Plasmonic Nanostructure |
| P182 | Broadband Electromagnetic Linear-Cross Polarization Conversion by Reflective Multiresonant Metasurface for Terahertz Waves |
| P183 | Theoretical Investigation of Differential Trapping of Nanoparticles by Femtosecond Optical Tweezers |
| P184 | Tailoring EPs in PT -Symmetric 1D Photonic Crystal with Liquid Crystal Defect Layer |
| P185 | Subwavelength Grating Metasurface for Polarization Dependent Antireflecting Coating |
| P186 | Actively Tunable Flexible Terahertz Metasensor |
| P187 | Guided Wave Coupled Surface Plasmon Polariton Mode Enhanced Plasmonic Charges Driven Solar Water Splitting |
| P189 | Tunable Faraday Rotation and Ellipticity of 1D Photonic Crystal with Defect of Electro-Optical and Magneto-Optical Materials |
| P191 | Modeling of Radiative Properties of Thermal Barrier Coating |
| P192 | Dual Wavelength Polarization Multiplexed Metalens for Ultracompact STED Microscope |
| P193 | From Inhibition to the Enhancement of Light Emission: Spontaneous Emission Rate of Coupled Quantum Dots Enhanced by Ordering Silver Nanowires |
| P194 | Hexagonal Boron Nitride Quantum Dots: Synthesis, Characterization for Single Photon Source and Spin Defects and Ab-Initio Studies |
| P195 | Impact of Higher Order Dispersion on Spatiotemporal Dynamics in Graded Index Multimode Fiber with Periodic Nonlinearity |
| P196 | Generation of Spatiotemporal Soliton in Normal Dispersion Regime of Transverse Index Media |
| P197 | Quartic Soliton from Low Power Airy Pulse |
| P198 | Swapping the Sign of Nonlinearity in Epinephrine: A Monoamine Neurotransmitter |
| P199 | Carbon Wrapped Zinc Sulfide Nanoparticles for Optical Limiting Application |

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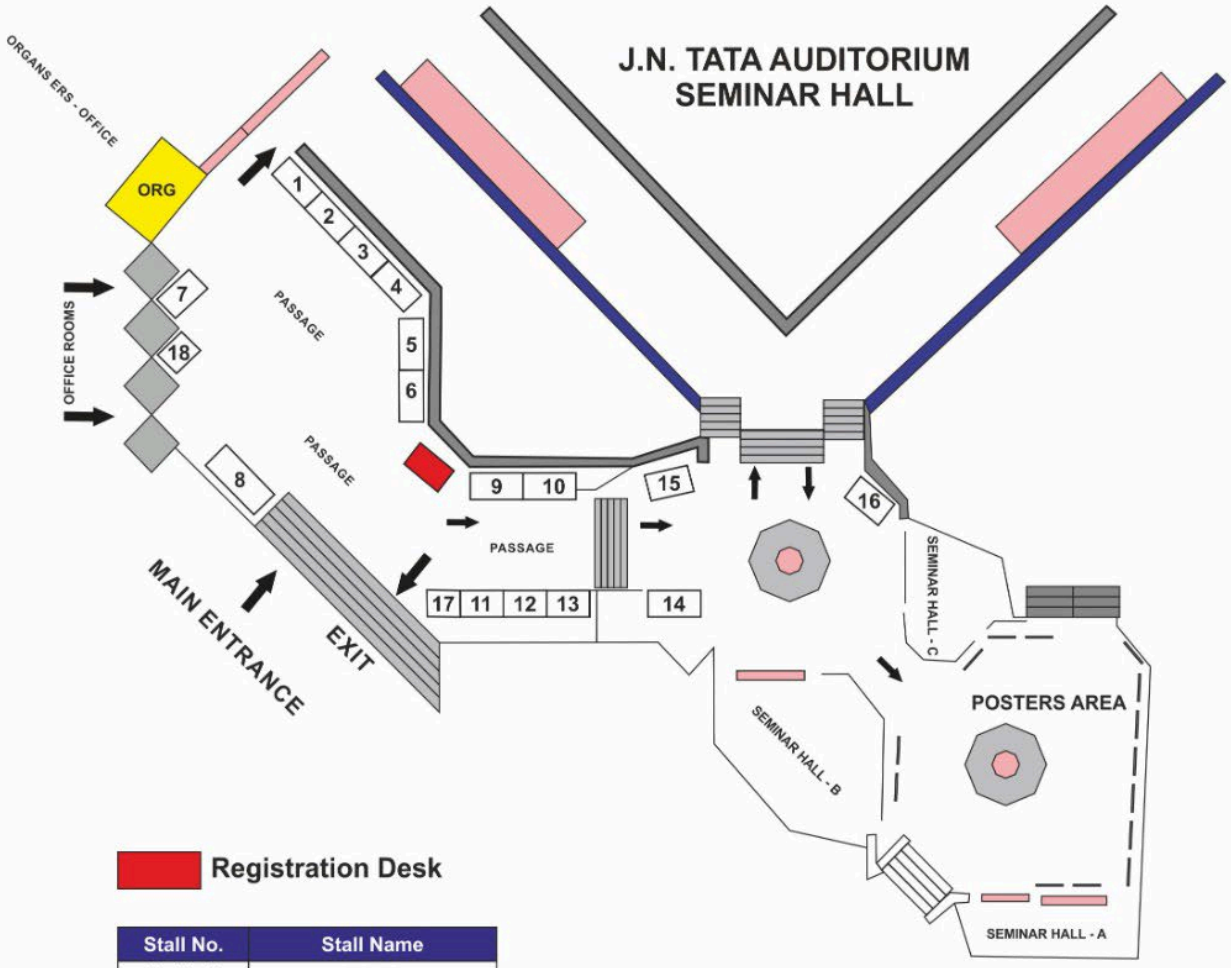
| **P200** | Enhancement of Optical Nonlinearity of Copper Nanoparticles via Surface Passivation |
| **P201** | Titanium Doped ITO: An Alternative to Improve Transmission in Visible Range |
| **P202** | Micropatterning of a Semi-Conducting Polymer Using Microbubble Lithography |
| **P204** | Study of EDFA for Application in Various Types of Optical Communication Links |
| **P205** | Energy-Efficient and Reliable 40 Gbps FSO Architecture with Rainfall Prediction Capability |
| **P206** | Application of S-Band for Protection in Multi-Band Flexible-Grid Optical Networks |
| **P207** | Performance Analysis of Hybrid BPSK-MPPM Modulated Multicore Fiber Interconnect System |
| **P208** | Design and Testing of Diffuse Reflection Collection Optics for Vis-NIR Spectroscopy for Soil Analysis |
| **P209** | Wide-Field Reflection Phase Microscopy with Scalar Optics Using Averaged Speckle-Illumination |
| **P210** | Comparative Study of Trap Stiffness with CW and Femtosecond Lasers |
| **P211** | Step-Height Measurement with Polarized Michelson Interferometer Using Geometrical Phase Shifting Technique |
| **P212** | Optical Profilometry of Industrial Samples Using Partially Spatially Coherent Monochromatic Light Source |
| **P213** | Remote Characterization of Ultrashort Pulses Delivered via Dynamic Fiber Optic Links in the Presence of Nonlinear Distortions |
| **P214** | Four-Shot Measurement of Complex Spatial Coherence Function |
| **P215** | Fusion of Hyperspectral and Multispectral Image for Remote Sensing Applications |
| **P216** | Modelling Radial Force for Femtosecond Optical Tweezers in Ray Optics Regime |
| **P217** | Study on Optical Properties of CFTS Synthesized Using Sol-Gel Dip Coating Method |
| **P218** | Improving Photon Up Conversion Efficiency Through Remote Trap Passivation of Colloidal Quantum Dots |
| **P219** | Effect of Annealing Temperature on the Performance of MoO3-x-Based UV Photodetector |
| **P220** | Optical Design and Modeling of Micro Light Emitting Diodes for Display Applications |
| **P221** | Generation of Nonclassical Light Through Circular Arrays |
| **P222** | Loss-Enhanced Biphoton Quantum Correlations in Silicon Waveguides |
| **P223** | Single-Sided Cavity Quantum Electrodynamics Effects on an Optical Nanofiber |
| **P224** | PT Symmetry Study in Asymmetrically Coupled Semiconductor Diode Lasers with Non-Zero Delay Time |
| **P225** | Multiplexing Quantum and Classical Light in Fiber Based Quantum Key Distribution |
| **P226** | Observation of Polarization Rotation with Pump Power in Three-Level Λ-Type Atomic System |
| **P227** | A Flexible Quantum Communication Network Using Broadband Entanglement and Wavelength Division Multiplexing |
| **P228** | Study the Effect of Spatial Varying Quarter Wave Plate on Vector Vortex Beam |
| **P229** | Wedge Plate Lateral Shear Interferometry for C-Point Detection |
| **P230** | Hybrid Integrated Photonic-MEMS Based Sensor |
| **P231** | First Principles GW-Bether Salpather Equation Excitonic Spectrum of Van der Waals Heterostructure: A Case Study in PtS2-SnS2 Interface |
| **P232** | Focus Shaping with Inhomogeneous Vector Beams Beyond the Diffraction Limit |
| **P242** | Deep Learning-Based Laser Back-Scattering Measurements for Qualitative Identification of Agricultural Seed Infection |

# PHOTONICS - 2023




Registration Desk

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| 9,10 | Hind High Vacuum |
| 5,6 | Keysight |
| 3,4 | ThorLabs and Melss |
| 7 | SIMCO |
| 8 | Laser Science |
| 14 | Ansys |
| 15 | Office of Communication, IISc |
| 16 | Springer |
| 1 | Laser Spectra |
| 2 | New Age Instruments |
| 17 | Advanced photonics |
| 18 | Toshniwal Brothers |

## PLENARY TALK-1 (5th July):

### Engineering Challenges for the Emerging Quantum Networks

Prof. Prem Kumar (Northwestern University, USA)

**Abstract**: Quantum internet of the future will require device functionalities that implicitly respect the fundamental facts such as quantum information cannot be copied and cannot be measured precisely. A quantum repeater, for example—analog of an optical amplifier that enabled global reach of the ubiquitous Internet connectivity we enjoy today—is yet to be demonstrated, although recent years have seen tremendous progress. Many other device functionalities—switches, routers, format converters, etc.—would also be needed that do not unnecessarily disturb or corrupt the quantum information as it flows from one node of the internet to another. In recent years, my group has engineered many quantum tools and techniques that fulfill the requirements for distributing quantum information in a networked environment. In this talk, I will present our motivation, design, construction, characterization, and utilization of some example techniques for near-term networked quantum applications.

**Bio**

Prem Kumar is Professor of Information Technology in the McCormick School of Engineering at Northwestern University. His research focus is on quantum photonic devices and their applications: generation, distribution, and ultrafast processing of photonic entanglement for applications in quantum information networks; novel quantum light states for precision measurements, imaging, and sensing; and novel optical amplifiers and devices for networked optical communications. Ph.D. graduates from his research group (35 completed & 5 in progress) have gone on to build careers in academia, industry, and the US national labs. His group has cumulatively published >500 research papers (Google Scholar h-index: 64). During 2013-2017, Dr. Kumar was a Program Manager at DARPA, where he created and managed a portfolio of programs in basic and applied sciences. He was selected Program Manager of the Year in 2015 and awarded the Secretary of Defense Medal for Outstanding Public Service in 2016. He is a Fellow of Optica (formerly OSA), APS, IEEE, IoP (U.K.), AAAS, and SPIE. He has been a Distinguished Lecturer for the IEEE Photonics Society, Hermann A. Haus Lecturer at MIT, recipient of the Quantum Communication Award from Tamagawa University in Tokyo, Japan, and the Walder Research Excellence Award from the Provost's office at Northwestern University. Since 2020 he is serving as the Editor-in-Chief of Optica (2021 Impact Factor: 10.6), the flagship journal of the Optica Publishing Group for high-impact results across the whole spectrum of optics and photonics, pure and applied.

## PLENARY TALK-2 (6th July)

## Precision Motorized Raman Nanosensors: New Paradigm for Biosensing

Prof. Donglei Emma Fan (Texas Materials Institute, The University of Texas at Austin, USA)

**Abstract**: In this talk, I will describe our efforts on motorizing surface-enhanced Raman nanosensors for biodetection with ultra-sensitivity, rationally enhanced speed, active molecule control, and precision positioning for subcellular probing. These nanosensors utilize high-density hotspots and metallic nanorod embedment, offering well-reproducible biosensing and controlled actuation with exceptional precision. By assembling them on designed photonic crystal slabs with electric fields, we not only position the sensors but also generate electrokinetic flows that concentrate analyte molecules to their hotspots, achieving photonic-plasmonic enhanced detection and molecule focusing with a robust Raman enhancement factor of ~2 × 109. Various biochemical compounds, including nucleobases and unsafe food additives, are readily detected in suspension.

Furthermore, we introduce capsule-shaped Raman nanosensors with a hierarchically porous structure, enabling tunable biochemical release via external electric voltages while benefiting from Raman enhancement due to the near-field effect. We further transform these sensors into nanomotors for accelerating the detection of trace-amount molecules, which provides an effective route in addressing the daunting challenge of obtaining both high-speed and ultra-sensitive biodetection.

Recently, leveraging the 3D electrokinetic tweezers, our new invention that offers a precision of 20 nm in positioning and 0.5° in angle control, we precisely transport and stably position an untethered bioprobe on a bacterial cell at multiple locations that successfully reveals single-cell's metabolite release.

**Biosketch**:

Dr. Donglei "Emma" Fan is an Associate Professor in the Department of Mechanical Engineering and a faculty member of the Materials Science and Engineering Program and the Texas Materials Institute at The University of Texas at Austin.

Dr. Fan holds the Robert & Jane Mitchell Endowed Faculty Fellowship in Engineering at UT-Austin since 2017 and received two prestigious awards from the US National Science Foundation (NSF), the NSF Mid-Career Advancement Award (2022) and the NSF CAREER Award (2012). Dr. Fan is a Fellow of the Royal Society of Chemistry (2021) and an invited Official Nominator of the Japan Prize (2017). She also is the 2022 Johns Hopkins Whiting School of Engineering Ilene Busch-Vishniac Lecturer; the lectureship "features outstanding women in engineering and highlights the intellectual contributions of the lecturers while serving to inspire young women to pursue degrees and careers in engineering".

Prof. Fan's research program focuses on the fabrication, manipulation, and assembly of intelligent, active micro/nanoscale structures, 3D hierarchical porous materials, and stimulus-responsive materials via understanding and exploiting fundamental materials science, physics, and chemistry. The efforts aim at addressing critical problems in robotics, sensing, biomedicine, water purification, and self-powered systems. She also develops precision tools used in biomedical research. She is an inventor of the "3D Electrokinetic Tweezers" technique that can manipulate longitudinal nanostructures

in aqueous suspension with a precision of 20 nm in positioning and 0.5° in angle under a standard optical microscope. Her team also discovered the effect of light-semiconductor-electric-field interaction that can be applied to realize multimodal reconfigurable nanodevices. Prof. Fan's research has spurred a series of publications in leading journals, including Nature Nanotechnology, Nature Communications, Science Advances, the Proceedings of National Academy of Sciences, Physical Review Letters, and Advanced Materials. Dr. Fan is particularly interested in technology transfer and entrepreneurship. She is an inventor of eight granted patents and a few pending patents. One patent has been licensed to a startup company.

Prof. Fan received her Ph.D. degree in Materials Science and Engineering and two MS degrees, one in Materials Science and the other in Electric Engineering, all from The Johns Hopkins University in US. She received an interdisciplinary education in both chemistry and physics from the Department of Intensive Instruction at Nanjing University, China, an honor program designed for talented undergraduates. She received early admission to the program, exempted from the National College Entrance Examination and awarded with a Freshman Merit Scholarship.

## PLENARY TALK-03 (HHV ANNUAL LECTURE), 7th July:

## The Birth of Picophotonics

Prof. Nikolay I. Zheludev (University of Southampton, UK and Nanyang Technological University, Singapore)

**Abstract:** Picometer scale events in the nanoworld can be monitored with topologically structured light while light-induced interactions and picometric movements can underpin Time Crystals – a new form of functional photonic materials.

**Short Bio**:

Professor Nikolay Zheludev, Deputy Director, Optoelectronics Research Centre, University of Southampton, UK and Director, Centre for Disruptive Photonic Technologies Nanyang Technological University, Singapore is a pioneer and world leader in the fields of nanophotonics and metamaterials. His accolades include the Michael Faraday medal, the Thomas Young Medal and President' Science and Technology Award by the President of Singapore. Zheludev is a Fellow of the Royal Society (UK) and Member of the National Academy of Engineering (USA)

## PLENARY TALK-04 (8th July):

## Semiconductor Quantum Dots: From Trap-States to Single Photon Purity and Charge Stabilization

Prof. K. George Thomas (Indian Institute of Science Education and Research Thiruvananthapuram, India).

E-mail: kgt@iisertvm.ac.in URL: https://www.kgtlab.in/; https://www.iisertvm.ac.in/faculty/kgt

**Abstract**: The semiconductor quantum dots (QDs) at the single-particle level exhibit mysterious episodes of photoluminescence (PL) intermittency, often called PL blinking, represented by ON-, GRAY-, and OFF-states which occur due to the trapping of charge carriers and Auger recombination. The first part of the presentation will discuss single-particle charge carrier dynamics in various QDs by employing various time-resolved PL measurements and strategies for controlling the undesirable OFF-states.1,2 Approaches for estimating single exciton and biexciton quantum yield in QDs and nanoplatelets, along with synthetic strategies for controlling exciton purity will be presented in the second part of the presentation.3 The presentation will also cover newer strategies for enhancing PL of QDs through plasmon resonance coupling.4 The last part of the presentation will focus on the potential applications of QDs in energy5 and electron transfer processes.6-8 By following various time-resolved transient absorption spectroscopic methods, we have demonstrated that the presence of deep hole trap states in InP QDs retards the charge recombination to a sub-millisecond timescale, which is seven orders of magnitude lower than that in CdSe QDs having shallow trap states.7 The role of the size of InP QDs on indium to phosphorous stoichiometry and the trap state distribution will also be discussed.8

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**Biography**:

K. George Thomas is a Professor and J C Bose National Fellow at the School of Chemistry of the Indian Institute of Science Education and Research Thiruvananthapuram, India. Research activities of KGT group focus on understanding the photochemistry and photophysics of molecular assemblies, plasmonic systems, semiconductor quantum dots, and chiral nanostructures using various steady-state and time-resolved techniques. George Thomas is a recipient of several awards and fellowships: the most significant ones are the J C Bose National Fellowship (2014-2024), and the Shanti Swarup Bhatnagar Prize in Chemical Sciences (2006). He is an elected fellow of both the Indian National Science Academy, New Delhi (2015) and the Indian Academy of Sciences, Bangalore (2007). He was the President of the Asian and Oceanian Photochemistry Association (2019-2021) and was a member of the Editorial Advisory Committee of the Journal of Physical Chemistry of the American Chemical Society (2012-2015).

## INVITED TALK-01:

## Quantum Experiments with Satellite Technology

Prof. Urbasi Sinha (RRI Bangalore)

**Abstract:** In India, our Quantum Information and Computing lab at RRI is working on a mega project called Quantum Experiments with Satellite Technology (QuEST) in collaboration with the Indian Space Research Organization. This is India's first satellite based Quantum Key Distribution (QKD) project which aims to develop indigenous technologies for satellite based QKD towards a quantum secure future for India. Here, we will report on several milestones achieved by the QuEST project. The first involves the development of a novel, indigenous QKD simulation toolkit qkdSim [1], as well as the establishment of a prepare and measure based QKD experiment. The simulation results match well with experiment; a representative key rate and the quantum bit error rate from experiment is 51±0.5 kbit/sec and 4.79%±0.01% respectively, wherein the simulation yields 52.83±0.36 kbit/sec and 4.79%±0.01%, respectively [2]. With this, we establish a prepare and measure based QKD protocol in the lab with an indigenous novel simulation toolkit, both very important milestones towards our quest for satellite based QKD in India. We will then discuss our demonstration of free space entanglement-based quantum communication between two buildings at RRI through an atmospheric channel, the first such demonstration in India, first performed in February 2021. Next we will discuss our recent work on passive feedback based polarisation scrambling mitigation, a crucial requirement for long haul quantum communications [3]. One of the major challenges in long distance quantum communications is the polarization degree of freedom of single-photons getting affected while transmission through optical fibres, or atmospheric turbulence. Conventionally, an active feedback-based mechanism is employed to achieve real-time polarization tracking. In this work, we propose an alternative, less resource intensive, passive feedback based approach. As a proof-ofprinciple demonstration, we implement an in-lab BBM92 protocol to exemplify the performance of our technique. We will end with our broad vision for the future in terms of a global quantum communication network.

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**Bio:** Urbasi Sinha is a Professor at the Raman Research Institute in Bangalore, India. She is heading the Quantum Information and Computing (QuIC) laboratory at RRI. Prof. Sinha is a Simons Emmy Noether Fellow at the Perimeter Institute, Canada as well as an associate faculty member at the Institute for Quantum Computing (IQC), University of Waterloo, Canada, and the Centre for Quantum Information and Quantum Control, University of Toronto, Canada. She completed her PhD at Cambridge University, UK, on experiments in high temperature Superconductivity. She completed her M.Sc in Physics also from Cambridge. She has been a Gates Cambridge scholar during her Ph.D and a Nehru-Chevening scholar during her masters. She was a post-doctoral research associate in the Cavendish labs, Cambridge as well as at IQC Canada. Her lab at RRI specializes in experiments on photonic quantum information processing including quantum computing and quantum communication, primarily using single and entangled photons. She is heading India's first project on satellite based secure quantum communications. Her scientific recognitions include the Homi Bhabha Fellowship in the year 2017 as well as the 2018 ICTP-ICO Gallieno Denardo Award in Optics. She was recognised as one of Asia's Top 100 scientists by the Asian Scientist for the year 2019 and has also been awarded the Simon's Emmy Noether Fellowship at the Perimeter Institute, Canada. In August 2020, she led the twomember winning team as a mentor, at the World Skills International Competition in Quantum Technology at the BRICS Future Skills Challenge, organised by the Russian Quantum Centre in Moscow, Russia with competitors from several countries worldwide. She won the ASSOCHAM Women in Cyber: Making a Difference award in the category "Cyber - Leading from the front" in 2021. Recently, she has been awarded the prestigious 26th SIES Chandrasekarendra Saraswathi National Eminence award for the year 2023 in the domain of science and technology.

## INVITED TALK-02:

### Entangled photon sources for free space and fiber-based quantum communication

Prof. Joyee Ghosh (IIT Delhi)

**Abstract:** Quantum entanglement is an important resource in experimental quantum optics, quantum information processing/computation, and quantum communication (QC). Photonic qubits, where information is encoded in the quantum state of the photons are an ideal choice for some of these applications, due to their speed, robustness and ease of manipulation. In particular, polarization-entangled photon pairs, due to their high entanglement purity and relative simplicity of generation, are key elements for quantum communication protocols and quantum key distribution, quantum networks, and quantum teleportation. Nonlinear optical techniques like spontaneous parametric down conversion (SPDC) and four wave mixing (FWM) are widely used for their generation in bulk crystals or waveguides. While bulk crystals are preferable for free-space optical QC experiments towards satellite QKD, all-fiber WDM-based waveguide sources are more suitable for fiber-based QC experiments towards multi-user QKD. Covering these aspects, I will talk about the recent endeavours and results of our Quantum Photonics group in IIT Delhi along these directions.

**Bio:** Joyee Ghosh is a B.Sc. (Physics Hons.) from University of Calcutta, Lady Brabourne College; M.Sc. and Ph.D. in Physics (2009) from School of Physical Sciences, JNU, INDIA, in collaboration with CNRS Laboratoire Aimé Cotton, Orsay, FRANCE. She was a Marie Curie postdoctoral fellow in ICFO- The Institute of Photonic Sciences, Barcelona, SPAIN; an Alexander von Humboldt fellow in Universität des Saarlandes, Saarbrücken, GERMANY; and a Joint Quantum Institute (JQI) postdoc fellow at NIST: National Institute of Standards and Technology, Maryland, USA till 2013. She joined the Indian Institute of Technology (IIT) Delhi, INDIA in 2013 as a Faculty of Physics and is currently an Associate Professor, leading the Quantum Photonics group, that works on quantum technologies and sources for free-space and fiber-based quantum communication, quantum squeezing and coherent light-matter interaction, among other interests. She is also a PI of prestigious research projects on quantum technologies funded by SERB, DRDO and DST-QuEST. Her research work was highlighted in ABP news online. She is an Expert member of the Joint Quantum Communication Working Group in ISRO and NMQTA: National Mission for Quantum Technologies & Applications, DST India.

**INVITED TALK-03:**

## Detecting Acoustics using Light - Opportunities and Challenges in Distributed Acoustic Sensing

Prof. Balaji Srinivasan (IIT Madras)

**Abstract**: Rayleigh scattering-based Distributed Acoustic Sensors (DAS) are capable of both detecting and quantifying dynamic acoustic perturbations along > 100 km of the sensing fiber with 10 m spatial resolution, constituting > 10,000 measurement points using a standard telecom-grade singlemode fiber. The basic working principle of DAS is the same as that of a Phase OTDR, in which the phase of the backscattered light is extracted from an optical fiber to detect refractive index variations induced by dynamic strain at different locations. As such, they have tremendous opportunities in intrusion sensing, pipeline monitoring, structural health monitoring and in seismology fields. In this talk, we discuss the working principle of DAS, the modeling of a DAS based on Rayleigh scattering, analysis of different phase extraction methods through simulation, and experimental studies on phase extraction using coherent detection. Challenges/limitations in this field as well as potential solutions would also be discussed.

## INVITED TALK-04:

## Development of High Power Lasers: Technology Challenges and Capabilities

Dr. Jagannath Nayak and Dr. Gaurav Singhal (Centre for High Energy Systems and Sciences, Hyderabad) #director@chess.drdo.in

**Abstract**: High power lasers (HPL) systems in modern defense scenarios are a coveted offset technology owing to their capability to greatly influencing offensive and defensive force balance. The scales of powers vary from few tens of kWs to MW class depending on the potential targets, ranges, mission types and operational scenarios. In this context, the prime laser sources being pursued are the Fiber laser, Gas lasers (COIL, DPAL) and the futuristic Distributed Gain medium Laser or Liquid Laser (LQL). Israel has demonstrated the Iron beam system [1], based on Fiber lasers, for protection against RAM and short-range missiles. Russia has inducted the Peresvet [2] and Zadira systems, which are essentially based on gas lasers. USA apart from pursuing the Fiber lasers employing spatial beam, spectral and coherent beam combining is actively developing small footprint 150-300 kW Liquid lasers (LL) [3] along with continued research on compact gas laser systems. CHESS is earnestly working towards developing systems based on Fiber lasers, Gas lasers and futuristic Liquid laser sources.

CHESS has already realized few kW Fiber laser sources with good beam quality and is working towards developing beam combining technologies viz., spatial, spectral and coherent for power scaling. The challenges include component availability, NLW laser sources and MLD gratings.

Gas laser sources as in case of Chemical Oxygen Iodine Laser (COIL) offer benefits of high efficiencies and high power single aperture output and challenges of compact module realization. CHESS has already developed proof of concept modules thereby proving technologies such as high yield singlet oxygen generation, mixing supersonic flow fields and efficient ejector pressure recovery.

Liquid Laser is a futuristic laser source with prime benefit of multiple modules being combined in a single resonator, with a compact thermal management. These lasers present an opportunity to scale laser power to mid ranges in appreciably smaller foot print of 2-5 kg/kW. CHESS has developed a small scale LQL source and is working towards its scaling. The complexities include, efficient pump coupling, mitigating optical wedge, resolving thermo-optical and hydro-optical instabilities. Hence, the state-of-the-art domain of High Power Lasers presents an opportunity of developing systems of power levels ranging from few tens of kW to MW class. However, the underlying technological challenges must be adequately addressed for realizing such laser systems for practical applications in the shortest possible time.

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Jagannath Nayak received the M.Sc. and Ph.D. degrees in electrical communication engineering from the Indian Institute of Science, Bengaluru, India., He has been with DRDO, India, since 1992. He has led the development of indigenous high performance fiber optic gyroscopes (FOG) as the Project Director. It is under production and became the backbone of Missile Avionics Systems. He is currently the Director of the Centre for High Energy System, and Sciences (CHESS), DRDO. Under his leadership India's first Laser based Anti-Drone Technology is developed, deployed and under production by Industries. He has published over 100 research papers in national and international journals, and conferences. Mr. Nayak is a member of several societies/organizations in various capacities like associate fellow/fellow/senior member/life member related to AFRIN, FNAE, OSI, IETE, IEEE, ISSS, ASI. He was a recipient of several awards and honors which include the Agni Excellence Award for Self-Reliance, the Nina Saxena Excellence in Technology Award, Aeronautical Society of India Swarna Jayanti Award and Assocham Excellence Awards for Development of Best Anti Drone Technology.

Gaurav Singhal received the doctoral degree in Mechanical Engineering from Indian Institute of Technology, Delhi, India. He is recipient of Indo-US Science and Technology (IUSSTF) Fellowship and completed his post-doctoral studies in the area of Aerospace Engineering and Sciences from Cockrell School of Engineering, UT, Austin, USA. He has been with DRDO, India, since 1999 and is presently a senior research scientist with CHESS, DRDO. He has extensively worked in domain of high power lasers, high speed unsteady flows, turbulent mixing, laser diagnostics and computational fluid dynamics techniques. He has published more than 100 research papers in international and national refereed journals and is a member of several societies and organizations.

**INVITED TALK-05:**

## Photonic Analog to Digital Converters-Challenges and opportunities.

Prof. Deepa Venkitesh (IIT Madras)

**Abstract**: The effective number of bits (ENOB) achieved in traditional electronic analog to digital converters (E-ADCs) are limited primarily due to the timing jitter of the sampling clock. Timing jitter achievable in ultra-short optical pulses is significantly lower than the electronic counterparts. Optical sampling is thus an attractive option to achieve better ENOB values. Such photonic sampled ADCs could also be used for sub-Nyquist sampling and can be potentially extended to frequency sensing applications.
RF signals, when modulated in the optical domain, are amenable to time-stretching and this reduces the effective E-ADC bandwidth. The key highlight of this photonic analog to digital converters (PADCs) is its ability to perform time-stretching in the optical domain; sampling and quantization can be carried out without compromising the signal to noise distortion ratio (SNDR) and the ENOB. In this talk, we discuss the principles of sampled and time-stretched photonic ADCs and the challenges associated with the experimental implementation of the same. We also discuss the possible opportunities with such ADCs.

## INVITED TALK-06:

### Broadband optical response and dynamics in plasmonic nanostructures.

Prof. Parinda Vasa (IIT Bombay)

**Abstract**: Surface plasmon polaritons are hybrid modes of light waves coupled to free electron oscillations in a metal that can be laterally confined below the diffraction limit [1-3]. In this talk, we discuss a hybrid structure comprising a nanocavity formed between gold film and TiO2 thin film, which confines the electromagnetic field within a small volume and supports large electric field enhancement [4]. The strong interaction with a gold nanoparticle partially embedded in the cavity further enhances the interaction giving rise to absorption over a broadband in the visible spectrum [1,4]. We also observe that the nonradiative relaxation of plasmonic resonances supported by the hybrid design act as a source of free electrons, which enhances photocatalysis activity in the proximity. The proof-of-principle is demonstrated by photobleaching of methyl orange dye film coated on the substrate.To investigate the dynamics of the hot electrons in plasmonic nanostructures, we start by measuring transient reflectivity of single-crystalline and poly-crystalline gold thin films in the visible range pumped by 400 nm femtosecond pulses [5]. The observed transient reflectivity changes are explained within a model based on the joint-density-of-states and Drude's response. Based on the experimental results and modeling, we evaluate the temporal evolution of the electron and phonon temperatures following the excitation by ultrashort pump pulses [5].We gratefully acknowledge the characterization and fabrication central facilities at IIT Bombay and the active participation of all group members and collaborators. The work has been financially supported by DST (DST/TMD (EWO)/IC5-2018/05) and Asian University Alliance.

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**INVITED TALK-07:**

## Metamaterials for physics and applications

Prof. Achanta Venugopal (TIFR Mumbai)

**Abstract**: Sub-wavelength featured metal-dielectric and all-dielectric materials with unique response to electromagnetic fields have become ubiquitous. Of interest is their application to different basic physics studies and device applications. From light-matter interaction in the perturbative and non-perturbative regimes to their role in single photon emitters to single molecule detection, they have a vital role. While the weak and strong coupling regimes are well studied, more recently the ultrastrong and deep strong coupling regime systems are hotly pursued in solid-state systems. In this talk, I will present some of our work on light-matter interaction in non-perturbative regime, and applications in biosensing, single photon emitters, magneto-plasmonics among others.

## INVITED TALK-08:

## Quantum Vacuum Dressed Materials in Terahertz Cavities

Prof. Junichiro Kono (Rice University, USA)

**Abstract:** There is currently considerable interest in studying solid-state materials placed in cavities to uncover exotic new phases and phenomena in "strongly driven" materials in the complete absence of any external fields other than the fluctuating vacuum, or zero-point, electromagnetic fields. Judicious engineering of the quantum vacuum surrounding the matter inside the cavity can lead to significant and nonintuitive modifications of electronic states, producing a vacuum-dressed material with novel properties. Recent stimulating theoretical predictions include cavity-enhanced, cavity-induced, and/or cavity-mediated enhancement of electron-phonon coupling and superconductivity, electron pairing, anomalous Hall effect, ferroelectric phase transitions, quantum spin liquids, and photon condensation. The so-called ultrastrong coupling (USC) regime arises when the interaction energy becomes a significant fraction of the bare frequencies of light and matter [1]. Most intriguingly, when a material is ultrastrongly coupled with cavity-enhanced vacuum electromagnetic fields (or zero-point fields), its ground-state proprties in thermal equilibrium can be modified. This nonperturbative virtual driving without any external field can lead to novel equilibrium phases with exotic properties.This talk will describe our recent studies of USC phenomena in various solid-state systems in search of such vacuum-induced phases of matter [2–9]. We employ the quantum optics concept of Dicke cooperativity [10], i.e., many-body enhancement of light–matter interaction, to explore new states and phenomena in condensed matter systems in the USC regime. These results provide quantum optical strategies for creating, controlling, and utilizing novel phases in condensed matter systems enabled by the quantum vacuum.

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**Bio:** Junichiro Kono received his B.S. and M.S. degrees in applied physics from the University of Tokyo in 1990 and 1992, respectively, and completed his Ph.D. in physics from the State University of New York at Buffalo in 1995. He was a postdoctoral research associate at the University of California, Santa Barbara, in 1995-1997 and the W. W. Hansen Experimental Physics Laboratory Fellow in the Department of Physics at Stanford University in 1997-2000. He joined the Department of Electrical and Computer Engineering of Rice University in 2000 as an Assistant Professor and was promoted to an Associate Professor in 2005 and to a Professor in 2009. He is currently Karl F. Hasselmann Chair in Engineering, serving as a Professor in the Departments of Electrical & Computer Engineering, Physics & Astronomy, and Materials Science & NanoEngineering as well as the Chair of the Applied Physics Graduate Program at Rice University. Professor Kono was a recipient of the National Science Foundation CAREER Award in 2002 and has been a Fellow of the American Physical Society (APS) since 2009, a Fellow of the Optical Society (OSA) since 2015, a Fellow of SPIE from 2019, and a Fellow of the Institute of Physics (IOP) since 2021. Professor Kono is also the founder of the nationally recognized international program for science and engineering undergraduate students, NanoJapan, funded by the U.S. National Science Foundation, receiving the Heiskell Award for Innovation from the Institute of International Education in 2008.

**INVITED TALK-09:**

## Quantum transduction of superconducting qubit in hybrid optomechanical system

Prof. Amarendra Kumar Sarma (IIT Guwahati)

**Abstract:** In this talk, I will discuss, taking a bottom-up approach, our recent work on quantum transduction of a superconducting qubit to an optical photon in electro-optomechanical and electro-optomagnonical systems. The electro-optomechanical system comprises a flux-tunable transmon qubit coupled to a suspended mechanical beam, which then couples to an optical cavity. Similarly, in an electro-optomagnonical system, a flux-tunable transmon qubit is coupled to an optical whispering gallery mode via a magnon excitation in a YIG ferromagnetic sphere. In both systems, the transduction process is done in sequence. In the first sequence, the qubit states are encoded in coherent excitations of phonon/magnon modes through the phonon/magnon-qubit interaction, which is non-demolition in the qubit part. We then measure the phonon/magnon excitations, which reveal the qubit states, by counting the average number of photons in the optical cavities. The measurement of the phonon/magnon excitations can be performed at a regular interval of time. I will also give a brief over-view of the area of hybrid optomechanical system.

## INVITED TALK-10:

### Vibrational spectroscopy for rapid bedside medical diagnosis

Prof. Senthil Murugan Ganapathy (University of Southampton, UK)

**Abstract:** Vibrational spectroscopy, in the form of Raman and Mid-IR spectroscopies, is a powerful, label-free technique that can identify and quantify individual components of a complex chemical mixture which makes it ideal for analysis of biosamples. Vibrational spectroscopic measurements are quick, simple and easy to perform, making the screening rapid and can be employed for the diagnosis of multiple conditions at once. We explore the use of vibrational spectroscopy for rapid point of care diagnosis. As an example, we study the diagnosis of neonatal respiratory distress syndrome of preterm babies. We are developing on-chip spectroscopy using low-cost and highly sensitive disposable chips. Together with machine learning, it will further simplify biomarker detection in the critical care for rapid and early diagnosis of disease.

**Bio:** Prof. Senthil Murugan Ganapathy received Ph.D (Photonic Materials) in 2001 from Indian Institute of Science, Bangalore. He worked as a post-doctoral fellow from 2001 to 2005 at the University of Bordeaux, France and Toyota Technological Institute, Japan. He joined the Optoelectronics Research Centre at the University of Southampton in 2005 where he is currently a Professor and Head of the Integrated Photonic Devices Group. He is also an Adjunct Professor at the Indian Institute of Technology - Madras, Chennai, India. He is Editor of Journal of Materials Science: Materials in Electronics published by Springer. He is Fellow of The Higher Education Academy of the UK.His expertise and research interests range from photonic materials to photonic systems with current focus on Mid-IR/high-contrast materials and devices for biomedical sensing, on-chip spectroscopy, on-chip nanoscopy, environmental monitoring and optical communication applications. He has published more than 250 journal and conference papers (h-index: 35) including more than 30 invited talks at major international conferences, 2 patents on new photonic glasses and editor of a book: “Photonic Glasses and Glass-Ceramics”.

## INVITED TALK-11:

## High-Resolution Optical Coherence Microscopy and Tomography of Biological Cells and Tissues: Effect of high spatial coherence of laser light on spatial phase sensitivity and accuracy in phase measurement

Prof. Dalip Singh Mehta (IIT Delhi)

**Abstract:** Optical coherence microscopy also known as quantitative phase microscopy QPM and tomography has recently become indispensable technology for quantitative analysis of various biological cells/tissues, such as, cancerous, and non-cancerous cells and tissues, sperm cells, macrophages, liver sinusoidal cells, and red blood cells. QPM generates high contrast imaging of nearly transparent biological specimen using their intrinsic refractive index contrast without any exogenous contrast agents, i.e., label-free. Key biophysical parameters that can be measured using QPM are, optical thickness, refractive index, cell dry mass, haemoglobin concentration, concentration etc. The key parameters controlling the measurement accuracy and capability of any QPM systems depends on its spatial and temporal phase sensitivity. The spatial phase sensitivity of QPM is governed by the coherence properties of the light source and temporal stability depends on the optical configuration of QPM whether it is common-path or non-common path in nature. Most of QPM techniques utilize highly coherent light sources like lasers benefited by their remarkable properties, such as, high spatial and temporal coherence, and brightness. High spatio-temporal coherence leads to occurrence of speckle noise and spurious fringes leading to inhomogeneous illumination and poor spatial phase sensitivity. In this work we demonstrate the effect of high spatial coherence of laser light on spatial phase sensitivity and accuracy in phase measurement1-3.

During the last few years, we have developed QPM systems using partially spatially coherent monochromatic (PSCM) light sources we call it optical coherence microscopy (OCM) and demonstrated 10-fold improvement in the space bandwidth product and phase measurement accuracy compared to laser4-6. Experimental results of accurate phase measurement of variety of cells, such as, sperm cells, cancerous and non-cancerous cells, HeLa cells, MCH cells using OCM will be presented. The OCM technique can differentiate between cancerous, non-cancerous cells easily without any labelling1-5. The results are also compared with histopathology images of the cells. Optical coherence tomography (OCT) is another label-free imaging technology for cross-sectional imaging of thick tissue samples. We have also developed high-resolution OCT for sub-cellular imaging of biological tissues. By means of engineering the spatial coherence of diode lasers we can obtain optically sectioned spatial coherence gated images of thick tissue samples without staining it. We demonstrate by means of combining OCM and OCT technology simultaneously we can realize label-free optical biopsy in real-time5-8. These modalities can be utilized during intra-operative procedure of breast cancer surgery, and tissue biopsy of oral cancer patients.

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## INVITED TALK-12:

### Light emission from Semiconductor and Plasmonic Nanoantennas

Prof. Naresh Kumar Emani (IIT Hyderabad)

**Abstract:** There is an explosion in demand for bandwidth from mobile devices to data centers and supercomputers. The power consumed by the electrical on-chip interconnects based on CMOS technology has become a significant part of overall chip power consumption and is fast becoming unsustainable. Integrated photonics aims to address this problem by integrating optoelectronic devices with the CMOS IC. It provides a viable path to improve the data rates in the near term and potentially disrupt computing technology in the next decade. In this talk, we will review the key challenges in realizing nanoscale light sources. We will then discuss our work at IIT Hyderabad on addressing the miniaturization of optical sources which is one of the key challenges in integrated photonics. We will present the recent developments in the area of lasing from high-index semiconductor nanoantennas and introduce the concept of parity-time symmetry within the context of photonics, wherein the interplay of the system's gain-loss and synergy between them leads to a scattering anomaly called lasing spectral singularity (SS). At SS, the transmission and reflection in the proposed metasurface tend to have large values, marking the onset of lasing with direction-sensitive emission properties. We will describe the dynamic tunability in the PT-symmetric phase gradient metasurface. The tunability in intensity and angular response of light is realized through dynamic gain-loss modulation. The talk will also discuss our efforts in optimizing MIM nanostructures for nanoantennas for nanoscale light emission.

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## INVITED TALK-13:

### Special filters for Silicon Photonic Integrated Circuits

Prof. Bijoy Krishna Das (IIT Madras)

**Abstract**: Owing to the success of high-speed silicon photonic transceivers for data centres, demand for similar products in several other fields such as 5G/6G, quantum photonic applications, etc. has emerged during recent years. Specialized photonic filter functions are the key for their successful realizations. In this talk, we will discuss some recent progress in this direction carried out at the Silicon Photonics CoE-CPPICS, IIT Madras.

**Bio:** Bijoy Krishna Das obtained his master's degree in solid-state physics from Vidyasagar University, Midnapore, India (in 1996) and Ph.D. degree (Dr.rer.nat) in integrated optics from the University of Paderborn, Germany (in April 2003). Prior to his Ph.D. research in Germany, Dr. Das started his research career in the area of integrated optics at the Microelectronics Centre, IIT Kharagpur for three years (January 1996 – December 1998). His postdoctoral research was carried out in three different countries First, he was an FRC Postdoctoral Fellow in the Graduate School of Engineering, Osaka University, Osaka, Japan (2004-2005). Later, he joined as a postdoctoral researcher in the Center for Optical Technologies, Lehigh University, Bethlehem, PA, USA. In April 2005, he re-joined the Integrated Optics Group at the University of Paderborn as Wissenschaftlicher Mitarbeiter and continued his research on integrated nonear optical devices. He also worked for a while at Laboratoire Aime Cotton, CNRS, Orsay, France. Since August 2006, Dr. Das has been associated with the Dept. of Electrical Engineering, IIT Madras, where he is presently holding a full Professor position. At IIT Madras, Prof. Das has been dedicated for establishing state-of-the-art silicon photonics research ecosystem following product research development and manufacturing (PRDM) model.

## INVITED TALK-14:

### Hong-Ou-Mandel interferometry-based quantum sensor

Prof. Goutam Samanta (PRL, Ahmedabad)

**Abstract:** Hong-Ou-Mandel (HOM) interference, the bunching of two indistinguishable photons on a balanced beam-splitter, has emerged as a promising tool for quantum sensing. The interference dip-width, thus the spectral bandwidth of interfering pair-photons, highly influences the resolution of HOM-based sensors. Typically, the bandwidth of the pair-photons, generated through parametric down-conversion, is increased using bulky and expensive ultrafast lasers, limiting their use outside the lab. We show the generation of photon pairs with flexible spectral bandwidth even using single-frequency, continuous-wave diode laser enabling high-precision, real-time sensing. Using a 1-mm-long periodically-poled KTP crystal, we produced high-brightness degenerate pair photons with a high spectral bandwidth resulting in a narrow HOM-dip to measure a displacement of 60 nm and vibration amplitude of 205 nm at a frequency of 8 Hz. Finally, we used the HOM interferometer to measure the temperature-dependent refractive index of nonlinear crystals as part of real-time, precision-augmented, in-field quantum sensing applications. In the current talk, I will explain the basics and our recent results on HOM interferometer-based quantum sensing results in detail.

**Bio:** Dr. Goutam K Samanta has received B. Tech and M.Tech degree in Optics and Optoelectronics from the University of Calcutta and Ph.D. in Photonics from The Institute of Photonics Sciences (ICFO), Barcelona, Spain. He joined Physical Research Laboratory India in October 2010. His research interest includes structured laser beams, nonlinear generation of structure beams, optical parametric oscillators, and the development of entangled photon source with high brightness. He has more than 140 technical contributions in peer-reviewed journals and conference proceedings, along with a post-deadline paper in CLEO 2015, USA. His recent results have been highlighted through the news release by OSA, research news by OPN, and Scilight. He is the recipient of the Gallieno Denardo award of the International Commission of Optics and ICTP for his contribution to Optics and Photonics, 2017, and the best thesis award, Indian Laser Association, 2009. He is a technical committee member of different national and international conferences, an Editorial board member of the Journal of Optics, UK, a life member of the Indian Laser Association, and a senior member of the Optical Society of America. He also served as a guest lecturer at IIT Gandhinagar and Ahmedabad University. Besides his regular research activities, Dr. Samanta promotes Optics and Photonics among school and college students in India through hands-on experiments. Through his dream project, “PRL Science Express”, his team demonstrated live science experiments to more than 50000 students in rural areas of Gujarat, Rajasthan, Madhya Pradesh and, Maharashtra since inception in 2018.

## INVITED TALK-15:

### Development of hybrid quantum devices using color defects in diamond

Prof. Kasturi Saha (IIT Bombay)

**Abstract:** Color centers in diamond have proven to be promising candidates for not only quantum computing, quantum sensing but also for quantum communications. Amongst the various color defects, nitrogen-vacancy centers (NV centers), silicon vacancy centers and germanium vacancy centers can be used to generate single photons in the visible and near IR wavelength ranges. In combination with photonic crystal cavities, single photons can be coupled with the spins qubits to form a hybrid quantum node. In this talk I will give an overview of our research towards the development single photon sources and hybrid quantum devices in diamond. In addition, I will briefly describe the first demonstration of dynamic widefield magnetometry using Nitrogen vacancy centers in diamond and its applications.

**Bio:** Kasturi Saha is an associate professor in the Department of Electrical Engineering at IIT Bombay. She was a postdoctoral fellow in Prof. Paola Cappellaro's group in the Research Laboratory of Electronics at Massachusetts Institute of Technology. She obtained her Ph.D. from Prof. Alexander Gaeta's group in the School of Applied and Engineering Physics in Cornell University. Prior to that she did her M.Sc. from IIT-Delhi and B.Sc.(Hons.) from St. Stephen's College, Delhi. Her research interests include quantum sensing, nano-photonics, precision metrology, and quantum computation with solid state color defects. She is a recipient of the Department of Science and Technology-INSPIRE faculty fellowship, IIT Bombay Young Faculty Award and the Venus International Young Faculty Award.

## INVITED TALK-16:

### Frontiers in Fiber Photonics Systems: Modal Interferometric to Hybrid Quantum Structures

Prof. Rajan Jha (IIT Bhubaneswar)

**Abstract:** Inline fiber photonics systems with high resolution, integrability, and reconfigurability have been central to the development of advanced and futuristic systems. High-resolution interferometers based on excitation of fundamental and higher order modes of processed and specialty fiber have been developed for industrial and healthcare applications. On the other hand, bidirectional and unidirectionality coupling of single photon require suitable interface. This can be achieved in a hybrid structure of elliptically faceted (ELFA) diamond nanowire with NV - centers integrated to optical nanowire for single photon collection and its further applications.

**Bio:** Rajan Jha is an Associate Professor at the Department of Physics, School of Basics Sciences at IIT Bhubaneswar, India. He leads a research program on Bulk and Fiber Photonics Systems on return from ICFO-The Institute of Photonics Sciences, Barcelona, after completing his postdoctoral. He works towards indigenous development of high-resolution novel interferometers and their combinations based multi-parameter interrogation systems, flexible/wearable photonic, cavity resonator sensors, plasmon coupled configurations at micro-nanoscale geared towards translation along with Hybrid quantum systems for single photon generation, detection and its metrological applications. He is an inventor of 9 patents, has published more than 125 SCI international journals; and is the author of four book chapters along with a Book on Fiber plasmonics. His published works have received more than 6500 citations (Google Scholar) with H Index-42. Due to his professional accomplishment and scientific service for his continuing efforts to serve the greater optics and photonics community, he was selected as an OSA Ambassador and Senior Member of Optica in 2017. He was awarded DAAD Fellowship (2013) to visit TU Berlin as visiting scientist and the JSPS Fellowship in 2009. He was a Regular Associate of the International Centre for Theoretical Physics (ICTP), Italy. Since 2021, he is Associate editor of IEEE sensors journal and Proceddings of INSA. For his breakthrough contribution to the design and development of photonics devices and for promoting research activities in India, he was awarded 2015 ICO/ICTP Gallieno Denardo award. In 2020, he received the SERB STAR Fellowship (Physical Sciences).

## INVITED TALK-17:

### Tunable thin film coatings for dynamic color generation and biosensing

Dr. Sreekanth K V (ASTAR Singapore)

**Abstract:** The components of future nanophotonic devices could be tunable and reconfigurable. However, the optical response of most of the nanostructures is fixed during the fabrication process. To date, various functional materials including electrically tunable materials have been used to tune the optical properties of nanophotonic structures. Among these, phase change materials (PCMs) based on chalcogenide semiconductor alloys have received great attention to tune the optical properties of nanophotonic systems in the ultraviolet (UV) to terahertz frequencies, due to their substantial refractive index change when switched between two structural states. Chalcogenide PCMs provide several advantages because of their reliable and repeatable non-volatile switching mechanism. In this talk, I will discuss the optical properties of various PCMs for UV, visible and near infrared photonics applications. In particular, I will present the development of various PCM-based thin film nanophotonic cavities and their applications in dynamic color generation and biosensing.

**Bio:** Sreekanth K V received his PhD degree in photonics from Nanyang Technological University, Singapore. He then worked as a Postdoctoral researcher at the department of Physics, Case Western Reserve University, USA and Senior Researcher at the Centre for Disruptive Photonic Technologies (CDPT), Nanyang Technological University, Singapore. He is currently working as a Scientist at the Institute of Materials Research and Engineering, ASTAR, Singapore. He is also serving as an Editorial Board member for Scientific Reports and Chemosensors (MDPI). His research interests focus on nanophotonics, plasmonics, phase change materials, metasurfaces and optical biosensors. He has published >55 peer-reviewed journal papers, one book and holds 1 USA patent.

## INVITED TALK:18

### Fourier Transform Infrared (FTIR) Micro-spectroscopy as a versatile tool for early detection of diseases

Prof. Basudev Lahiri (IIT Kharagpur)

**Abstract:** Fourier Transform Infrared (FTIR) based micro spectroscopic tools have emerged as powerful techniques for disease detection and characterization. By exploiting the unique vibrational properties of biomolecules, FTIR microspectroscopy enables the identification and analysis of biochemical changes associated with various diseases. The FTIR technique operates on the principle that different molecules absorb and emit infrared light at specific frequencies, generating characteristic spectra. When applied to biological samples, such as tissues, cells, or biofluids, FTIR microspectroscopy can detect and quantify alterations in the molecular composition and structure. These alterations are often indicative of pathological conditions, making FTIR a valuable tool for disease diagnosis and monitoring. In cancer research, FTIR microspectroscopy has demonstrated its ability to discriminate between healthy and cancerous tissues by identifying changes in protein, lipid, and nucleic acid profiles. It enables the identification of specific biomarkers associated with different cancer types and can aid in early detection, prognosis, and monitoring of therapeutic responses. In addition to cancer, FTIR microspectroscopy has been applied to the detection and characterization of other conditions, including cardiovascular diseases, diabetes, infectious diseases, and autoimmune disorders. It provides insights into molecular alterations in blood, urine, or saliva samples, aiding in disease classification, therapeutic monitoring, and personalized medicine. In this talk, I would share the various disease diagnostics performed in my research group (Nano Bio Photonics group, IIT Kharagpur) using the FTIR microspectroscopic tool. Their ability to probe molecular composition and structure offers valuable insights into the underlying mechanisms of various diseases. FTIR microspectroscopy holds great potential for advancing biomedical research, facilitating early disease diagnosis, and guiding personalized therapeutic interventions. Photonics 2023 Basudev Lahiri IIT Kharagpur

**Bio**: Basudev Lahiri is an Assistant Professor at the Electronics Engineering Department of IIT Kharagpur. Prior to this, he was a Lord Kelvin Adam Smith Fellow at the University of Glasgow, United Kingdom and a Researcher Associate at the National Institute of Standards & Technology (NIST), Gaithersburg, United States. Dr Lahiri's speciality lies in Nanofabrication and Optical characterization of various nanomaterials. He has over fifteen years of experience in various nanofabrication techniques as applied to Biophotonics. He combines his expertise both as a designer of nanophotonics devices and as a developer of new optical characterization techniques to produce novel sensor technologies for the early detection of diseases.

## INVITED TALK-19:

## Ultrafast Structural Dynamics in Molecular Adducts Featuring Photo-initiated Proton-coupled Electron Transfer

Prof. Y Adithya Lakshmanna (IISER, Thiruvananthapuram)

**Abstract:** The capture and control of early-time events of molecules and materials upon photoexcitation lies at the heart of ultrafast spectroscopy. Unraveling the excited state dynamics that are typically governed by a complex interplay of various factors such as substituents, intramolecular and intermolecular interactions poses serious challenges to traditional linear spectroscopic techniques. In this talk, I shall demonstrate that a judicious mix of diverse ultrafast nonlinear spectroscopic techniques such as femtosecond transient absorption spectroscopy, fluorescence upconversion, and stimulated Raman spectroscopy can lead to deciphering the intricacies in complex excited state dynamics. I shall describe the ultrafast excited-state structural dynamics in molecular adducts involving photoacids and photobases such as 4-cyano-4'-hydroxystilbene:tert-Butylamine, 4-dimethylamino-styrylpyridine:hexafluoroisopropanol, Hydroxynaphthaldehyde:Methylimidazole and provide an analysis of the spectroscopic signatures associated with the photo-initiated proton-coupled electron transfer reactions in these systems.

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**Bio**: Y. Adithya Lakshmanna obtained an integrated B. Sc. Ed degree from Regional Institute of Education, Mysore and an M. Sc. Degree in Physics from Indian Institute of Technology, Madras. Subsequently, he pursued PhD in Physical Chemistry from Indian Institute of Science, Bangalore working under the supervision of Prof. S. Umapathy. Adithya is currently an Assistant Professor at the School of Chemistry, Indian Institute of Science Education and Research Thiruvananthapuram. His research interests are broadly in the direction of addressing the excited-state reaction dynamics that are mediated by fundamental processes such as electron transfer, proton transfer and proton-coupled electron transfer. His research group employs a multitude of time-resolved spectroscopic techniques that include time-resolved Raman, infra-red and circular dichroism spectroscopy.

## INVITED TALK-20:

### Self-induced Transparency in a Semiconductor Quantum Dot medium at ultra-cold temperatures

Prof. Tarak Nath Dey (IIT Guwahati)

**Abstract:** We investigate the feasibility of minimum absorption and minimum broadening of pulse propagation in an inhomogeneously broadened semiconductor quantum dot medium. The phonon inter- action is inevitable in studying any semiconductor quantum dot system. We have used the polaron transformation technique to deal with quantum dot phonon interaction in solving system dynamics. We demonstrate that a short pulse can propagate inside the medium with minimal absorption and broadening in pulse shape. The stable pulse area becomes slightly higher than the prediction of the pulse area theorem and is also dependent on the environment temperature. The change in the final pulse shape is explained very well by numerically solving the propagation equation supported by the susceptibility of the medium. Our system also exhibits the pulse breakup phenomena for higher input pulse areas. Therefore, the considered scheme can have important applications in quantum communication, quantum information, and mode-locking with the advantage of scalability and controllability.

[1] Samit Kumar Hazra, P. K. Pathak, and Tarak N. Dey, Phys. Rev. B, 107, 235409 (2023)

**INVITED TALK-21:**

**Reconstructive Spectrometer using Photonic Crystal Cavity**

Prof. Shilpi Gupta (IIT Kanpur)

**Abstract:** Reconstructive spectrometers utilize computational algorithms to reconstruct input spectrum from wavelength-dependent spatial patterns generated by a dispersive element. This reconstruction approach reduces the footprint of the spectrometer without compromising on resolution. Until recently, this approach has been mostly implemented in platforms that require complex and expensive fabrication processes and are sensitive to optical misalignment. In this talk, I will present our laboratory's recent work in which we demonstrated a reconstructive spectrometer using a planar one-dimensional photonic crystal cavity. This spectrometry platform utilizes a simple and scalable fabrication technique and is robust to optical misalignment.

**Bio**: Shilpi graduated from IIT Delhi with a B. Tech. in Engineering Physics. She then obtained her MS and PhD in Electrical and Computer Engineering from the University of Maryland, College Park, USA. Currently, she is a faculty member in Electrical Engineering at IIT Kanpur. She is broadly interested in studying the physics of nanoscale phenomena and engineering them to develop nanophotonic devices.

**INVITED TALK-22:**

**'Spinstruck' particles in optical tweezers: from photonic wheels to planetary motion**

Prof. Ayan Banerjee (IISER Kolkata)

**Abstract:** The configuration of optical tweezers, where light is focused tightly to diffraction-limited spot sizes, leads to the generation of large geometric phase gradients that induce the spin-orbit interaction of light. Thus, input circularly polarized light of a particular helicity produces light having the opposite helicity, as well as orbital angular momentum, near the focal region of the tweezers. In addition, the presence of a large longitudinal component of the field gives rise to transverse spin, which is often referred to in the literature as photonic wheels. These exotic rotational effects are accentuated in the presence of a refractive index stratified medium in the light path of the optical tweezers. We demonstrate a host of clear experimental demonstrations of diverse complex rotational motion in highly birefringent particles trapped in stratified optical tweezers developed out of both fundamental, as well as structured Gaussian beams. Thus, the observations range from the elusive transverse rotation of single particles, to multiple particles simultaneously spinning and orbiting around another particle, which itself is also spinning. Such remarkable examples of multi-particle rotation mimicking planetary motion have been hitherto unobserved in optical tweezers. Our observations also pave the way for designing complex rotational micromachines exploiting the spin-orbit interaction of light in optical tweezers.

## INVITED TALK-23:

### Optical microscopy beyond diffraction limit through structured illumination

Prof. Joby Joseph (Optics and Photonics Centre, IIT Delhi)

**Abstract:** Microscopy is an important tool for studying the structure and properties of materials, and for identifying and characterizing small objects or organisms. However, the resolution we can achieve from optical microscopes is limited by diffraction. However recent years, many new optical techniques have come up with higher resolutions that break this diffraction limit. These microscopy techniques are called super-resolution microscopy or nanoscopy. There are several super-resolution microscopy techniques such as Structured Illumination microscopy (SIM), Stimulated Emission Depletion (STED) microscopy, Single molecule localization microscopy (SMLM) etc. SIM even though gives a modest resolution enhancement, it stands out from others in many ways due to its practical usages. The biggest limitation of SIM is that even though it is faster than other super resolution microscopy technique, it is still limited to two times resolution enhancement. The talk will focus on the development of a novel Transillumination -SIM [TSIM] that circumvents this two times resolution enhancement limit and has high space bandwidth product. TSIM decouples the imaging and illuminating part by using mirrors. A multi-mirror setup generates illumination patterns with higher spatial frequencies than can be achieved from the imaging objective lens.

## INVITED TALK-24:

### Exploring the B-Exciton-Trion Dynamics in Monolayer Transition Metal DiChalcogenides

Dr. Krishna Bharadwaj Balasubramanian (IIT Delhi)

## INVITED TALK 25:

### Optothermal Tweezers Based on Colloidal Plasmonic Nanostructures

Prof. G.V. Pavan Kumar (IISER, Pune)

**Abstract:** The non-radioactive component of surface plasmons can be utilized to create opto-thermal potentials. In this presentation we will discuss the utility of plasmonic nanostructures such as gold nanoparticles and silver nanowires as optical trapping centres of individual nano-structures. Specifically, we will discuss how individual nano-diamonds can be trapped and spectroscopically interrogated using this method.

**Bio:** Prof. G.V. Pavan Kumar is professor of physics at the Indian Institute of Science Education and Research (IISER), Pune. He obtained his PhD from JNCASR, Bangalore. Subsequently he was a postdoctoral fellow at ICFO-Barcelona and Purdue University, before joining IISER in 2010. His research interests are at the interface of optics and soft-matter physics. He is also interested in history and philosophy of science and is a blogger and podcaster.

## INVITED TALK-26:

### Non-local, non-linear, and non-Hermitian nanophotonics

Prof. Gururaj Naik (Associate Professor, Rice University)

**Abstract:** Miniaturing optical resonators into meta-atoms and packing them together in meta-devices have revolutionized nanophotonics. Building various meta-atoms have been extensively studied in the past. However, packing them together into meta-devices remains less explored. Quantum many-body effects offer a novel direction in this regard. Here, we discuss two approaches – emulating and integrating quantum many-body systems – to deliver meta-devices exhibiting quantum many-body effects. Emulating quantum many-body effects in nanophotonics is difficult because nanophotonic resonators only weakly confine light in them. Radiative and often non-radiative losses are not negligible in nanophotonics necessitating non-Hermitian physics. We demonstrated a non-Hermitian metasurface based on passive parity-time symmetry. We coupled a lossy plasmonic resonator with a lossless dielectric resonator to achieve the best of plasmonics and photonics, i.e., enhanced absorption as in plasmonics and high Q-factor as in dielectric photonics. Further, we demonstrated non-trivial topology in this system resulting in robust directional thermal emission. Here, we will discuss the directionality of thermal emission from such metasurfaces. We show that a highly asymmetric thermal emission is possible from a transparent metasurface held at 900 K. Such directional, bright, and spectrally selective thermal light sources could be revolutionary for thermal imaging and efficient thermophotovoltaic energy conversion. In another approach, we combine quantum materials with nanophotonics to leverage powerful design tools. We study the optical properties of a layered charge-density-wave (CDW) material, 1T-TaS2 under illumination and electrical bias. We observed a unity-order index change in 1T-TaS2 under both stimuli. Our investigation showed that charge density wave (CDW) domains reorganize into a different stacking order under a stimulus. As a result, the optical response of this quantum material is not only non-linear but also non-local. We build a non-local model to capture the light-matter interaction in 1T-TaS2 and other quantum materials and understand the energy landscape of strong correlations in this material. Measuring non-locality could be a non-invasive probe of the quality of a quantum material and thus could catalyze the discovery of functional quantum materials. Further, we demonstrate a tunable 1T-TaS2-based metasurface with 100% modulation depth, MHz bandwidth, and ultralow-power operation. Such tunable optical devices could be disruptive for emerging imaging and display applications.

**Bio:** Gururaj (Guru) Naik is an associate professor of Electrical & Computer Engineering, at Rice University. He received an M.E. from the Indian Institute of Science, India, and a Ph.D. from Electrical & Computer Engineering, Purdue University. During his Ph.D. with Shalaev and Boltasseva groups, he developed new plasmonic materials for nanophotonic applications. After pursuing postdoctoral research at Stanford University, Guru joined Rice University in 2016. His research group focuses on topics at the interface of quantum, nanophotonics, and materials. Guru and his group have won many awards and recognitions for their research work including 10,000+ citations with two of his papers cited over 1000 times, the best presenter and poster awards at MRS symposia, and many invited talks. Guru is a recipient of the IEEE Photonics Society Graduate Student Fellowship, an Outstanding Graduate Research Award from Purdue University, and a Gold Medal from the Indian Institute of Science.

## INVITED TALK-27:

## Designs and Optimisation of Linear and Nonlinear Photonic Devices

Prof. B M Azizur Rahman (University of London, UK)

**Abstract:** A review on the characterisations of emerging optical waveguides, such as silicon nanowires, plasmonic waveguides with two-dimensional confinement and optical slot waveguides will be presented. Design and optimisation of emerging linear and nonlinear photonic devices, such as multi-octave supercontinuum generation, high SBS gain by co-propagating light and sound, and agile PIC incorporating non-volatile phase change materials will be presented. All simulations are carried out by using numerically efficient full vectorial finite element method.

**Bio:** B. M. Azizur Rahman received the B.Sc.Eng and M.Sc.Eng. degrees in Electrical Engineering with distinctions from Bangladesh University of Engineering and Technology (BUET), Dhaka, Bangladesh, in 1976 and 1979, respectively. He also received two gold medals for being the best undergraduate and graduate students of the university in 1976 and 1979, respectively. In 1979, he was awarded with a Commonwealth Scholarship to study for a PhD degree in the UK and subsequently in 1982 received his PhD degree in Electronics from University College London.

In 1988, he joined City, University of London, as a lecturer, and became a full Professor in June 2000. At City University, he leads the research group on Photonics Modelling, specialised in the use of rigorous and full-vectorial numerical approaches to design, analyse and optimise a wide range of photonic devices. He has published more than 700 journal and conference papers, and his journal papers have been cited more than 9000 times and h-index of 41. He has supervised 36 students to complete their PhD degrees as their first supervisor and received more than £13 M in research grants. Prof. Rahman is Life Fellow of the IEEE, and Fellow of the Optical Society of America (Optica) and the SPIE.

## INVITED TALK-28:

### Microring resonators-a versatile platform for integrated and quantum photonics

Prof. Shailendra K. Varshney (IIT Kharagpur)

**Abstract:** Microring resonators (MRRs) are the most sought on-chip optical components after the optical waveguides due to versatile usages and functionalities whether in linear or nonlinear and quantum properties. A simple MRR geometry consists of one or two straight waveguides and circular or bent waveguides. Several variants and many applications of MRRs have been explored over a decade. Among the popular applications of these tiny MRR is in nonlinear and quantum photonic applications, whether it is on-chip stabilized frequency comb or quantum sources operating at room temperature. In this talk, I'll provide a brief overview of these on-chip resonators and will present few applications such as stabilized frequency comb and quantum sources.

**Bio:** Dr. Varshney received the M.Sc. degree in physics from Aligarh Muslim University, Aligarh, India, in 1999 and the Ph.D. degree in applied physics (on photonic crystal fibers) from University of Delhi, Delhi, India, in 2005. In November 2008, he joined the Department of Electronics & Electrical Communication Engineering and the Department of Physics, Indian Institute of Technology (IIT), Kharagpur, India, where he is currently Professor in the Dept. of E&ECE. He is an associate faculty of School of Nanoscience and Nanotechnology, School of Energy Science and Engineering of IIT Kharagpur. He was an adjunct faculty of School of Electrical Sciences of IIT Bhubaneswar during autumn 2016 and 2017.

He is the recipient of several fellowships-UGC/CSIR JRF fellowship from the Government of India (2000–2002), the Monbukagakusho scholarship from the Government of Japan (October 2002–March 2004), the JSPS fellowship (April 2007–November 2008), and the Alexander von Humboldt fellowship from Germany (2009), DAAD fellow (2015). Dr. Varshney has been the recipients of Faculty Excellence Award (2019) and G S Sanyal Faculty Excellence Award (2020) by IIT Kharagpur.

He is the author and co-author of more than 90 research papers in peer-reviewed journals and more than 120 papers in conference proceedings. His research interests include photonic components and devices, application specific specialty fibers, nonlinear photonics, quantum photonics, metaphotonics and optical wireless communication. Dr. Varshney has been involved in various sponsored projects in the area of nonlinear and quantum from various funding agencies, including DST and ISRO. He has successfully completed two international projects with Russia and Japan and currently carrying out project on high repetition source development with KAIST, South Korea.

He is a senior member of the Institute of Electrical and Electronics Engineers (IEEE) USA and Senior Member of Optical Society of America (OSA), now Optica. He was the faculty advisor for the OSA's student chapter at IIT Kharagpur from 2013-2015. He is also traveling lecturer under OSA and served as a Chair of IEEE Kharagpur Section. He is currently serving as a chairman of Partha Ghosh Academy of Leadership at IIT Kharagpur since Jan. 2022.

## INVITED TALK-29:

### Modal Analysis Excess Noise in Ultrafast Lasers: A Quantum-Inspired Approach

Dr. Syamsundar De (Assistant Professor, IIT Kharagpur)

**Abstract:** Ultrafast pulsed lights from mode-locked lasers, which feature optical frequency combs (OFCs) in the frequency domain, have wide range of metrological applications such as spectroscopy, time/frequency distribution, ranging, remote sensing, measurement of fundamental constants, optical clocks, to name only but a few. These applications broadly rely on the remarkable stability and the intrinsic broadband phase coherence of an OFC though, in practice, presence various noises in an OFC limits the measurement sensitivity. Therefore, analysing the OFC noise is of paramount importance to attain the fundamental sensitivity limit. However, a complete analysis of the noise in an OFC, which can contain up to a million of frequency lines, is extremely challenging as this requires probing amplitude and phase noises of each of the constituent frequency line. Nevertheless, it has been found that the OFC dynamics, linked to its intrinsic broadband phase coherence, is primarily governed by only a few distinct global parameters, e.g., the pulse energy, the carrier-envelope-offset (CEO), the repetition rate, and the central wavelength. Subsequently, the OFC noises manifest themselves as fluctuations of these global parameters. Measurement and control of the noise in each of these global parameters separately has already been widely investigated. And in these studies, different parameter noises were assessed using different measurement setups, for instance, pulse energy fluctuations are directly measured using a single photodiode, CEO noise is probed using so-called f-2f scheme that relys on the beating of the comb spectrum with its frequency-doubled counterpart, and timing jitter is analyzed through heterodyning with a refence laser or with itself using an unbalanced interferometer. However, from these different noise measurement schemes it is quite cumbersome to find the relative contribution of the individual parameter noise to the overall OFC noise as it requires careful calibration of the various setups and suitable normalization. In this talk, I will discuss a novel modal approach that allows simultaneous retrieval of all the OFC parameter noises and their comparison on the same scale using a single measurement setup. In this modal approach, firstly, we employ a novel measurement technique that combines spectrally resolved detection with balanced homodyne detection allowing simultaneous retrieval of both amplitude and phase quadrature noises in different spectral bands of the OFC. We then reconstruct noise covariance matrices, and subsequently their eigenvalue decomposition that yields independent noise modes (eigenmodes) and the associated noise spectra (eigenvalues). Finally, we link each OFC parameter, which associates itself to a particular temporal/spectral shape of the optical field, to a particular noise mode. To conclude, I will present how our modal approach based on standard continuous-variable quantum optics tools and techniques such as covariance matrix and homodyne enables, on the one hand, investigation of phase-amplitude noise correlations, and on the other hand, analysis of the noise of any pulsed light source in general.

**Bio**: Dr. Syamsundar De is currently an Assistant Professor in the Advanced Technology Development Centre at IIT Kharagpur. He received his Master degree from Ecole Polytechnique (France). He received his PhD from Paris-Saclay University (France), and was awarded with the Best PhD thesis Prize from the university. He worked for several years as postdoc at Sorbonne University (France) and Paderborn University (Germany) before joining IIT Kharagpur. His research interests include ultrafast quantum optics, complex quantum networks, high-dimensional quantum encoding, hybrid quantum systems combining discrete-and continuous-variable techniques, time-frequency metrology, laser dynamics and noise.

**INVITED TALK-30:**

## Noble Metal-Based Plasmonic Nanostructures: Expanding Photonics Frontiers in Biomedical Applications

Dr. Amit Jaiswal (IIT Mandi)

**Abstract:** Plasmonic nanostructures based on noble metals, like gold and silver has contributed significantly towards the area of photonics. These materials exhibit unique size and shape dependent optical properties at the nanoscale, enabling precise control over light-matter interactions leading to applications in various fields. Herein, we will discuss about the applications of plasmonic nanostructures specifically nanorattles, particularly in the biomedical field. The first part of the talk will provide a comprehensive overview of the fundamental principles underlying the shape and size dependent localized surface plasmon resonance (LSPR) phenomenon of plasmonic nanoparticles. In the second part, we will delve into the diverse applications of noble metal-based plasmonic nanostructures, with a specific focus on biomedical applications. These include: (a) Photothermal therapy: By utilizing the strong light absorption properties of plasmonic nanostructures, photothermal therapy can be achieved, where targeted heating of tumor cells occurs upon exposure to near-infrared light. This non-invasive technique shows great potential for cancer treatment. (b) Surface-Enhanced Raman Scattering (SERS): Plasmonic nanostructures can provide highly sensitive SERS substrates for the detection of trace analytes and for bioimaging. By enhancing the Raman signals of reporter molecules plasmonic SERS bioimaging enables imaging and sensing.

**Bio:** Dr. Amit Jaiswal earned his B.Tech. degree in Biotechnology from Heritage Institute of Technology Kolkata in 2008, followed by an M.Tech. in Biotechnology from IIT Guwahati in 2010. He pursued his doctoral studies at the Centre for Nanotechnology, IIT Guwahati, and successfully obtained his Ph.D. degree in 2013. After completing his Ph.D., he conducted post-doctoral research at Washington University in St. Louis, USA, and Technion – Israel Institute of Technology, Haifa.

In 2014, Dr. Jaiswal joined IIT Mandi as an assistant professor and currently holds the position of Associate Professor in the School of Biosciences and Bioengineering, IIT Mandi. His research focuses on the field of nano-biotechnology. In recognition of his outstanding research contributions, he was honored with the Department of Atomic Energy (DAE) Young Scientist Research Award in 2017 and the MAHE Young Scientist Award in 2018. He is also an Associate of the Indian Academy of Sciences.

Dr. Jaiswal's research achievements were further acknowledged with the Indian National Science Academy (INSA) medal for young scientists, and his team received the GYTI 2021 appreciation award. He has authored 45 peer-reviewed journal articles and contributed to 5 book chapters.

## INVITED TALK-31:

## On-Chip THz Silicon Topological Photonics for 6G to XG

Prof. Ranjan Singh (NTU Singapore)

**Abstract:** Global digitalization and the recent rise of artificial intelligence-based data-driven applications have directed their vectors towards terabits per second (Tbps) communication links. The fast-evolving 5G communication network cannot fulfill this demand due to several technological challenges, including bandwidth scarcity, which has stimulated innovative technologies with a vision of 6G communication. Semiconductor and emerging quantum material-inspired Terahertz (THz) micro-nanotechnologies have been identified as critical candidates for the emerging 6G communication with the potential to provide ubiquitous connectivity and remove the barrier between the physical, digital, and biological worlds. Nonetheless, the existing THz photonic on-chip communication devices suffer from backscattering, bending loss, limited data speed, and lack of active tunability.

Here, I will describe a new class of quantum-inspired on-chip THz photonic topological devices consisting of low-loss, broadband single channel 160 Gbit/s interconnect and antenna devices. Silicon topological photonics will pave the path for augmentation of CMOS-compatible hybrid electronic-photonic-spintronic driven terahertz technologies, vital for accelerating the development of future 6G to XG communications that would empower societies with real-time terabits per second wireless connectivity for network sensing, holographic communication, cognitive internet of everything, and massive digital cloning of the physical and the biological world.

**Bio**:

Ranjan Singh is an Indian scientist and an Associate Professor at Nanyang Technological University (NTU) Singapore. He received B. Eng. in Telecommunications from Bangalore University (2001), M. Tech in Photonics from Cochin University (CUSAT), and a Ph. D. in Photonics from Oklahoma State University (2009). During 2009-2013, he was a postdoc at the Los Alamos National Laboratory. He founded TeraX Labs in 2013 at the Division of Physics, NTU Singapore. He is an elected fellow of OPTICA (OSA) for pioneering contributions in ultrafast terahertz photonics, active metamaterials, and sensors. His current research interests include terahertz electronic-photonic hybrid technologies for 6G communications, THz topological photonics, THz spintronics, and quantum materials. He has raised US$ 12M in competitive research grants, including a US $7M to develop on-chip terahertz topological photonics for 6G communication (TERACOMM).

## INVITED TALK-32:

## Can excited-state trions be brightened in doped semiconductor quantum wells using magnetic fields: A comparison with van der Waals semiconductors

Prof. Ashish Arora (IISER Pune)

**Abstract:** Following the recent discovery of doubly-excited 2s trion states in van der Waals semiconductor monolayers [1], there is a significant focus on investigating their magneto-optical signatures from both theoretical and experimental perspectives. However, in the conventional doped two-dimensional (2D) quantum wells, such excited trion states have not been observed so far. The bottleneck in their detection is their tiny binding energies in the 2D quantum wells (1 – 2 meV) combined with a small oscillator strength. This is in strong contrast to 2D semiconductor monolayers such as of WS2, where the trions have an order of magnitude larger binding energy (~25 – 50 meV) and oscillator strength.

In this talk, I will first describe our discovery of the 2s trions in an hBN-encapsulated monolayer of WS2 using temperature-resolved $\mu$-absorption and $\mu$-photoluminescence spectroscopy [1]. Thereafter, I will compare it with the challenging case of the unintentionally-doped GaAs quantum well systems. We propose to overcome the two bottlenecks in their detection i.e. small binding energy and oscillator strengths by applying an out-of-plane magnetic field. Furthermore, instead of absorption and photoluminescence spectroscopy, we propose to use sensitive methods such as magneto-optical Kerr effect (MOKE) spectroscopy [2] to detect weak signatures of the excited trion states. I will discuss our initial results in this direction [3].

Our work is important for addressing fundamental questions pertaining to the experimental observations of excited trion states in conventional quantum wells.

References:

1) Arora et al., “Excited-state trions in monolayer WS2”, Phys. Rev. Lett. 123, 167401 (2019)

2) Arora et al., “Magneto-optical Kerr effect spectroscopy based study of Landé g-factor for holes in GaAs/AlGaAs single quantum wells under low magnetic fields”, J. Appl. Phys. 113, 213505 (2013)

3) Jain et al. (under preparation)

**Bio:**

Ashish did his PhD from TIFR, Mumbai in the Department of Condensed Matter Physics and Materials Science in 2014. He was a CNRS postdoctoral researcher in National High Magnetic Field Laboratory (LNCMI-CNRS), Grenoble, France for a year (2014-15). He won the prestigious A. v. Humboldt grant for a postdoc in the University of Muenster, Germany (2015-17). Thereafter, he won the highly competitive German Research Foundation (DFG) grant and stayed as a junior group leader in the University of Muenster until August 2021. During this time, he won the European Magnetic Field Laboratory EMFL prize 2019 ‘for his ground-breaking discoveries using the excellent infrastructure at the EMFL facilities’. Since 2021, he is an Assistant Professor at IISER Pune.

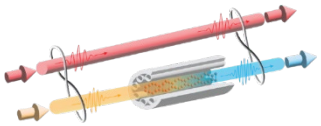
## INVITED TALK-33:

## Gas-filled photonic crystal fibres for the generation and manipulation of sources of non-classical light

Prof. Nicolas Joly (MPI, Erlangen, Germany)

**Abstract:** We present the generation of tunable sources of biphoton by adjusting the pressure of noble gas filling a hollow-core photonic crystal fibre. By filling the fibre with xenon, we can generate pairs of photons with up to 2 octaves of frequency separation. Using molecular gas, we show that we can shift one photon of a generated pair of entangled photons with an efficiency of over 70% without losing the correlations present in the initial source. Biphotons are an essential tool for many applications in quantum optics, ranging from quantum communication to spectroscopy with undetected photons. By contrast with spontaneous down conversion in second-order nonlinear crystals, spontaneous four-wave mixing (sFWM) leads to the creation of signal ($s$)and idler ($i$)correlated photons starting from two pump photons according to $\omega_! - \omega_" = \omega_" - \omega_\#$. Because signal and idler are generated symmetrically from the pump frequency ($\omega_"$), accessing unusual frequency domains, such as ultraviolet does not require exotic pump frequency. For the process to take place, phase-matching conditions $2\beta_" = \beta_! + \beta_\# + 2\gamma P$ , where $\gamma$ is the nonlinear coefficient and P the peak power of the pump, must be fulfilled. Here we show the generation of biphotons in an 18.5 µm diameter single-ring anti-resonant hollow-core photonic crystal fibre (SR-PCF). Pumping the 30 cm-long fibre filled with 16-20 bar of xenon with 310 fs long mode- locked pulses from an amplified Ti: Sapphire laser operating at 800 nm, we generated tunable sidebands separated by up to an octave [1]. Pumping our system at 400 nm with 6.7 ps- pulsed on the other hand we generated signal photons with wavelength as low as 235 nm, while its complementary yields in the much more accessible region of IR $\lambda_\#$ = 1342 nm, more than 2 octaves away. Such a source could allow for the first-time spectroscopy in the ultraviolet using undetected photons [2]. In the second part, we will discuss the possibility to use molecular gas to manipulate the spectral properties of an existing source of biphotons. In silica optical fibres, stimulated Raman scattering yields the deleterious generation of "red photons", which drastically hamper the quality of quantum sources. Less known, however, is that we can turn this serious drawback into a real asset by preparing a coherent pattern of molecular vibrations by stimulated Raman scattering in hydrogen-filled SR-PCF (Fig.1). In that case, the beating between the pump and Stokes signal leads to a moving refractive index grating travelling at the velocity $v\$\% = \Omega\&/\Delta\beta$ , where $\Omega\&$ the Raman resonance and $\Delta\beta$ the wavevector of the coherence wave. This moving coherence wave can subsequentially cause Doppler frequency shifting of any weak signal as long as phase-matching condition is fulfilled, which requires $78\beta\%! - \beta!'\#()9 - \beta\$\%7 \approx 0$. There $\beta\%!$ , $\beta!'\#()$ , and $\beta\$\%$ are respectively the propagation constants of the weak signal, the shifted signal, and the coherence wave. To demonstrate the frequency conversion of single photons from a source of entangled pair of photons, we used an SR-PCF filled with ~70 bar of H2 gas pumped by a Q- switched 1064 nm laser, which yields the coherent pattern of molecular vibration along the fibre length. Part of the pump is used to generate a biphoton in a suspended core photonic crystal fibre. The signal photon from the entangled source is coupled into the H2-filled SR-PCF that is utilized for thresholdless phase-matched frequency conversion by 125 THz, while preserving the correlation of the original entangled pair with up to 70% conversion efficiency. We believe that such a tool can be efficiently combined to develop new types of sources for quantum optics.

Figure 1: Schematics of the frequency converter using a SR-PCF filled with H2-gas. A coherent pattern of molecular



vibrations is first prepared by stimulated Raman scattering. Subsequentially, one photon from the entangled pair is scattered off the moving grating. Reproduced from [3].

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[1] S. Lopez-Huidobro, M. Lippl, N. Y. Joly, and M. V. Chekhova, "Fiber- based biphoton source with ultrabroad frequency tunability," Opt. Lett., vol. 46, no. 16, p. 4033, Aug. 2021, doi: 10.1364/OL.434434.

[2] S. Lopez-Huidobro, M. V. Chekhova, and N. Y. Joly, "Tunable fiber source of entangled UV-C and infrared photons." arXiv, Feb. 15, 2023. doi: 10.48550/arXiv.2302.07798.

[3] R. Tyumenev, J. Hammer, N. Y. Joly, P. St. J. Russell, and D. Novoa, "Tunable and state-preserving frequency conversion of single photons in hydrogen," *Science*, vol. 376, no. 6593, pp. 621–624, May 2022, doi: 10.1126/science.abn14

**INVITED TALK-34:**

## Fiber-mediated secure information exchange in the quantum world

Prof. Bhaskar Kanseri (IIT Delhi)

**Abstract:** Establishing secure communication in the quantum world is quite demanding and challenging affair. The quantum era is governed by Quantum Physics, which offers a framework to test fundamental aspects of quantum mechanics such as coherence, entanglement, and non-classical properties of light-matter. More recently, it has led to the development of quantum technologies which aim to harness quantum principles for promising applications in computing, communication, sensing and precision metrology. This area has evolved significantly in recent years, and last year Physics Nobel prize has also been awarded for ground breaking experiments in these domains. Quantum key distribution (QKD) is a method of quantum cryptography, which has become a new generation security solution and does not rely on the computation assumptions of problems presumed difficult. QKD can provide a secure means for information exchange even in the presence of quantum computers. Optical fiber offers a reliable quantum channel for QKD well tested for existing telecommunication, which can offer not only point to point connectivity but also a means for long distance information exchange. This talk will begin with realizable sources of single and entangled photons useful for quantum secure communication, and would further highlight some implementations of fiber based QKD made by our group at IIT Delhi in lab scale and in real field environment. Notably, the first Indian long distance intercity fiber QKD ranging more than 100kms, and entanglement distribution for 50km fiber would be discussed. The prospects of photonic quantum technologies would also be highlighted emphasizing on field deployable devices for QKD and hybrid quantum networks for future quantum internet.

## INVITED TALK-35:

## Vanadium Dioxide: Synthesis to Applications

Prof. Amit Verma (IIT Kanpur)

**Abstract**: Vanadium dioxide ($VO_2$) is a phase-transition material which exhibits a reversible structural and an associated insulator-metal transition at 68 ºC. This phase transition is accompanied with a large change in $VO_2$ resistivity and dielectric-response properties enabling a host of electromagnetic switching applications from microwave to THz, Infra-red and visible wavelengths. Vanadium forms a plethora of oxides due to its multivalent nature which makes stabilization of the $VO_2$ phase during synthesis challenging. In this talk, a low thermal budget $VO_2$ synthesis technique (APTO: Atmospheric pressure thermal oxidation) will be presented which enables integration of $VO_2$ with crystalline, amorphous and flexible substrates while maintaining good phase transition properties. Several applications demonstrated using the APTO $VO_2$ in infrared, RF and visible wavelengths will also be presented.

**Bio**:

Amit Verma is currently an Associate Professor in the Department of Electrical Engineering and Prof. T. R. Vishwanathan Young Faculty Fellow at IIT-Kanpur. His research interests include thin film growth, fabrication, and characterization of devices based on wide-bandgap semiconductors and phase-change materials. Before joining IIT Kanpur, he obtained Integrated-M.Tech. in Engineering Physics from IIT-BHU, Varanasi in 2010, and Ph.D. in Electrical Engineering from University of Notre Dame, USA, in 2015. Subsequently, he worked on oxide growth and devices as a postdoc at Cornell University, USA.

## INVITED TALK-36:

## Integrated Optical Control of Atomic Systems

Dr. Amit Agrawal (National Institute of Standards and Technology Gaithersburg, MD, USA, amit.agrawal@nist.gov)

**Abstract**: Over the last decade, flat optical elements composed of an array of deep-subwavelength dielectric or metallic nanostructures of nanoscale thicknesses – referred to as metasurfaces – have revolutionized the field of optics. Because of their ability to impart an arbitrary phase, polarization or amplitude modulation to an optical wavefront as well as perform multiple optical transformations simultaneously on the incoming light, they promise to replace traditional bulk optics in applications requiring compactness, integration and/or multiplexing. Recent demonstrations including imaging, polarimetry, quantum-light generation and LIDAR demonstrate the range of technologies where metasurfaces have already had a significant impact. In this talk, we demonstrate the versatility of wavefront shaping metasurfaces as a compact, efficient and multifunctional interface to trap neutral atoms or address trapped ions for applications in quantum information science and atomic clocks. In another integration step, combining metasurfaces with photonic integrated circuits, replacing bulk optical elements, promises increased complexity and functionality in a batch-fabricated optical microsystem ultimately fully replacing the laboratory optical table to enable cold atom clocks and quantum computers.

**Biography**: Amit Agrawal leads the Ultrafast Nano-optics Group in the Microsystems and Nanotechnology division within PML at NIST. He received a Bachelors in Electronics and Telecommunications Engineering from India and, M.S. and Ph.D. in Electrical Engineering from the University of Utah. Following that, he did his postdoc at UMD/NIST, where he worked in the areas of plasmonics and metamaterials. He then joined the faculty of Syracuse University for three years before returning to NIST in 2014. At NIST his group works in the areas of ultrafast optics, nonlinear optics, nanofabrication and integrated photonics. His research work in the last few years has primarily focused on developing metasurfaces and integrated nanophotonic devices operating from the ultraviolet to the near-infrared to scale and/or miniaturize quantum systems based on atoms and ions for applications in quantum sensing and computing.

**INVITED TALK-37:**

## Understanding plasmons in a multi-phase thin films and nanostructures: An example of Ag-Cu alloy system

Prof. Shourya Dutta Gupta (IIT Hyderabad)

**Abstract**: Plasmonics deals with the study of optical resonances supported by metallic nanostructures and thin films. Plasmonic nanostructures have been used for the development of ultrasensitive sensing platforms that can detect even single molecules. Conventionally, noble metals like gold, silver and copper have been used for making the nanostructures supporting strong plasmon resonances. More recently, there has been significant attention paid to alloy plasmonics due to their increased tunability. In this talk, I will demonstrate two different aspects of alloy plasmonics using the Ag-Cu alloy system. In the first part of the talk, I will talk about propagating surface plasmons supported by Ag-Cu alloy thin films. The effect of composition and microstructure on the surface plasmon behavior will be elucidated using both experimental and numerical tools. Experimentally, such complex alloy thin films were fabricated using magnetron co-sputtering process followed by vacuum annealing. In the second part of the talk, I will look at the localized plasmons supported by Ag-Cu nanoparticles. The effect of various geometrical parameters on the plasmon resonance as well as the Raman enhancement for a given laser wavelength will be demonstrated. It will be shown that these two-phase particles exhibit dual resonances which can be exploited for realizing SERS based biosensors

## INVITED TALK-38:

## Leveraging the Spin-orbit Interaction of Light

Prof. Nirmal K. Viswanathan (School of Physics, University of Hyderabad)

**Abstract:** The chirality of a medium is typically measured either by transmitting a beam of light through it or by single or multiple interface reflection at large and/or special angles of incidence. We propose and demonstrate experimental measurement of surface chirality of z-cut quartz crystal by reflecting a focused beam of light at a near-normal angle of incidence. The spin-orbit interaction (SOI) results in a small difference (of 10−4) in the reflection coefficients between orthogonal elliptically polarized incident beam. This is measured in the dark-field region of the reflected light via weak measurement method, taking advantage of the significant transverse spin-shift (TSS) that arises due to the interaction. The TSS behaviour is simulated for different chiral parameters (± γ) of the material. The experimental results match well with the theoretically simulated behaviour to quantify γ of quartz crystal used as an example interface. The significance of our method will be of interest for a wide variety of fundamental and applied investigations.

**Bio:**

Nirmal Viswanathan is currently a Senior Professor in School of Physics, University of Hyderabad. He has published more than 100 papers in international journals with an equal number in conferences and has 8 US / World patents. His current research interest includes characterization and application of optical beams generated via spin-orbit interaction of light and the role of geometric phase. Apart from keen interest in fundamental research, he teaches Undergraduate and Masters level theory and laboratory courses.

**INVITED TALK-39:**

## Our Journey with Polarized Light: From Spin orbit interaction of light, Quantum weak measurements to Polarimetry

Prof. Nirmalya Ghosh (IISER Kolkata)

**Abstract:** Spin (SAM) and orbital angular momentum (OAM) of photons are usually ascribed to the quantum nature of light. However, classical light beams can also carry both SAM and OAM, which are associated with circular / elliptical polarization and phase vortex, respectively. Thus, the evolution of polarized light beam in curved trajectory mimics the spin orbit interaction (SOI) effects of a massless spin 1 particle (photon). In this talk, I shall discuss some of our recently observed intriguing SOI effects of classical light beam, like spin and orbital hall effect, photonic spin-momentum locking in plasmonic metamaterials etc. In this context, I shall also discuss the realization of quantum weak measurements using classical polarized light, which we have employed to amplify the SOI effects. Finally, I shall provide a very brief account of our research in the interdisciplinary application domain of classical polarized light, that for the characterization of complex nano and biomaterials using nano-sensitive polarimetry.

**Bio:**

Nirmalya Ghosh is a physicist with specialization in optical physics and photonics. He joined Indian Institute of Science Education and Research (IISER) Kolkata, India in 2010 and is currently Professor in the Department of Physical Sciences and Centre of Excellence in Space Sciences India (CESSI), IISER Kolkata. At IISER Kolkata, he developed and runs bio-optics & Nano-photonics (bioNap) research laboratory. The group has made important contributions in areas of spin (polarization) optics, weak measurements, plasmonics and biophotonics. He is the recipient of the G. G. Stokes Award in Optical Polarization given by SPIE. He is a Fellow of Indian Academy of Sciences and Fellow of National Academy of Sciences, India. He has authored over hundred papers in peer-reviewed international journals, and has also written several invited reviews, book chapters and a text book in the area of optical physics and photonics.

**INVITED TALK-40:**

## Orbital Angular momentum entanglement

Prof. Anand Kumar Jha (IIT Kanpur)

**Abstract:** The fact that a photon in a light beam can carry orbital angular momentum (OAM) in the integer multiples of $\hbar$has made OAM a very important degree of freedom for quantum information and quantum metrology. However, the efficient techniques for generating and detecting high-dimensional OAM entangled states have been lacking, which severely limits the potential applicability of such states for real-world applications. In this talk, I will present our recently-developed techniques for efficiently generating and detecting OAM-entangled states with dimensionalities up to 200. I'll also present our experimental demonstrations of a novel feature of two-photon OAM-entanglement, by which any decay of OAM entanglement due to atmospheric turbulence or otherwise can be revived simply by propagating the two photons a little further away.

**Biography:** Dr. Anand Kumar Jha obtained his 5 years' integrated MSc in Physics from IIT Kharagpur in 2002 and his PhD from the University of Rochester in 2009. After doing a postdoc for about a year at the University of Rochester, Dr. Jha worked with Intel corporation for about two years and then joined IIT Kanpur as an assistant professor of Physics in 2013. Since 2022, he has been a professor of Physics at IIT Kanpur. Dr. Jha has setup a "quantum optics and entanglement" laboratory at IIT Kanpur and carries out research in the broad areas of classical & quantum coherence, quantum entanglement, and quantum metrology.

**INVITED TALK-41:**

## Birefringence and dichroism effects in the spin noise spectra of a spin-1 system

Prof. Fabien Bretenaker (LuMIn, CNRS France)

Authors: Shikang Liu(1,2), Joseph Delpy(1), Pascal Neveu(1), E. Wu (2), **F. Bretenaker**(1) and F. Goldfarb(1)

(1) LuMIn, CNRS - Université Paris-Saclay, France
(2) East China Normal University, Shanghai, China

**Abstract**: Spin noise spectroscopy (SNS) is a powerful optical technique to study the fluctuations, dynamics and lifetimes of spin systems in various systems. However, most of the systems studied till now have been described as spin-1/2 systems. In this work, we show how the peculiarities of metastable helium at room temperature allow to unveil the particular behaviour of spin fluctuations in spin-1 systems, in which both circular and linear birefringence and dichroism effects can be observed.

**INVITED TALK-42:**

## Femtosecond THz dynamics in metallic heterostructures

Prof. Sunil Kumar (IIT Delhi)

**Abstract:** Terahertz (THz) time-domain spectroscopy using efficient sources and detectors of THz radiation has become a powerful experimental tool for non-destructive testing of materials and can be used to probe various fundamental linear/nonlinear physical processes. In modern applications, compact and efficient THz sources and detectors are in demand which are cost-effective and can be applied in a broad frequency range. Femtosecond laser excited spintronic heterostructures have emerged as a potential candidate for powerful and broadband THz radiation sources. Increasingly popular systems in this regard are the bi- and tri-layer combinations of thin films of ferromagnetic (FM) metal and nonmagnetic (NM) heavy metal. Inverse spin Hall effect (ISHE) in the NM layer is majorly considered as the main mechanism to develop a transient current source which emits THz radiation. We have used THz emission spectroscopy to study the evolution of the THz emission from modified heterojunction in such heterostructures.

**Bio:**

Sunil Kumar joined the Physics Department, IIT Delhi in May 2015, where he is currently working as Associate Professor. Prior to joining IIT Delhi, he worked at the Department of Physics of Complex Systems, Weizmann Institute of Science, with Prof. (late) Yaron Silberberg from year 2012 to 2015. During this time, he was responsible for the development of coherent anti-Stokes Raman microscope in an European mega consortium FAMOS project. Sunil Kumar obtained his Masters in Physics from Indian Institute of Technology Delhi in 2004 and later, PhD in experimental condensed matter physics from Indian Institute of Science Bangalore in 2012 with Prof. A. K. Sood. During this time, he completed part of the thesis work in Universite de Bordeaux, France in 2007. He has also received training on the development of high power femtosecond lasers at the Spectra Physics factory in San Jose, California, USA in 2006. He received Gold Medal for best PhD thesis of Physics Department, IISc Bangalore in 2012. At IIT Delhi, Sunil Kumar teaches physics courses to the undergraduate and graduate students. His research interests include ultrafast optics, nonlinear optical processes, THz spectroscopy, and physics of quantum materials.

**INVITED TALK-43:**

## Resonant Second-Harmonic Generation as a Probe of Quantum Geometry

Prof. Amit Agarwal (IIT Kanpur)

**Abstract:** Nonlinear responses are actively studied as probes of topology and band geometric properties of solids. Here, we show that second harmonic generation serves as a probe of the Berry curvature, quantum metric, and quantum geometric connection. We generalize the theory of second harmonic generation to include Fermi surface effects in metallic systems, and finite scattering timescale. In doped materials the Fermi surface and Fermi sea cause all second harmonic terms to exhibit resonances, and we identify two novel contributions to the second harmonic signal: a double resonance due to the Fermi surface and a higher- order pole due to the Fermi sea. We discuss experimental observation in the monolayer of time reversal symmetric Weyl semimetal WTe2 and the parity-time reversal symmetric topological antiferromagnet CuMnAs.

**Bio:**

Prof. Amit Agarwal is a theoretical physicist known for his work on quantum transport, optical phenomena, and collective excitations in quantum materials. He received his Ph.D. from the Indian Institute of Science in 2009 and spent three years as a postdoctoral researcher at the Scuola Normale Superiore in Pisa, Italy. He joined the Indian Institute of Technology-Kanpur in 2012, where he is a professor in the Department of Physics. Prof. Agarwal has made significant contributions to the field of condensed matter theory, and he is widely recognized for the originality, depth, and overall impact of his work.

## INVITED TALK-44:

## Study of Magneto-optical Effects for Nanophotonic Applications

Prof. Ranjani Viswanatha (JNCASR Bangalore)

**Abstract**: Doping in semiconductors has given rise to some very interesting observations, specifically providing energetically accessible multiple spin state configurations. However, lack of understanding of these properties, specifically at room temperature, has not given rise to interesting spintronic applications so far. In this talk, I discuss the concepts of magneto-optics, its signature in quantum dots. I then turn our attention to the various magneto-optical properties in doped quantum dots using single dopant as well as the two dopants, their mutual interactions and possibility of demonstrating these properties at room temperature. Specifically, I plan to discuss the effect of optical perturbation on the two spin states producing magnetically inequivalent excitonic states and their effects on spintronic applications as well as photo-induced magnetism. We use ultrafast pump-probe spectroscopy and density functional theoretical analysis and magnetic circular dichroism to establish the presence of the Magneto-Optical Stark Effect (MOSE)[1] and the Zeeman effect. Their effects on the temperature and time will be discussed providing a stepping-stone for spin-dependent applications.

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**INVITED TALK-45:**

## Planar Optics for Applications Spanning Microwave to Visible Range Wavelengths

Prof. R. Vijaya, IIT Kanpur

**Abstract:** To miniaturize optical instruments by making them more compact and to reduce their weight, it is useful to design and fabricate surfaces with different functionalities. One of the approaches for this purpose is to opt for planar optics and by using frequency selective surfaces for spectral control. Such surfaces contain a large number of patterns, whose size and spacing are chosen suitable to the required frequency range. The choice of the substrates, the size of the patterns, their shape and spacing, their lattice arrangement and the method of preparing such surfaces differ based on the frequency range of the application. It is also useful to stack surfaces or build multiple periodicities in the form of heterostructures to achieve the objectives. In our work, we design and fabricate frequency-selective surfaces, as well as metasurfaces, for the electromagnetic frequency range spanning from microwaves to visible range. Some of the applications studied by us include antireflection, wide-band frequency filtering, spatially wider diffraction, polarization control in transmission and broadening of the stopband frequency range. For this purpose, we have used hard and soft substrates as well as various methods of patterning on them to achieve the size and shape of patterns required for the chosen application. We have also used metallic and dielectric materials relevant to the frequency range to derive the best benefits.

Keywords: Frequency-selective surfaces, metasurfaces, optical applications

**Bio**:

Vijaya is a Professor at IIT Kanpur. She is an experimental researcher interested in all topics of research related to Optics and Photonics. Her research group works on topics spanning nonlinear optics, fiber optics, nanophotonics, optical devices, miniature lasers, plasmonics, microstrip patch antennas and metasurfaces, all with an emphasis on applications. She has received significant funding from major sponsors for establishing a wide-ranging experimental infrastructure for Photonics research. She has served in many leadership positions in the last 10 years at IIT Kanpur. She is a senior member of SPIE, Optica and IEEE, and has held executive positions in all of them.

**INVITED TALK-46:**

## Tera-Hertz (THz) Spectroscopy Applied to the study of Materials

Prof. Shriganesh Prabhu, (TIFR Mumbai)

**Abstract:** Over the last two decades, Terahertz (THz) spectroscopy research has been growing quite fast. The potential of THz Spectroscopy is quite high and has found numerous applications across several different disciplines of Science, Technology, Arts and Security. Due to the lack of high power sources and detectors, there is a big gap in security applications of this technology. The main challenge lies in the development of high power THz Source and sensitive THz Detector technology development . Due to lack of cheap, compact, easy-to- use, room temperature tabletop high power THz emitting sources and equally sensitive, convenient to use room temperature detectors, the progress has been stalled. Several novel ideas have been tried by us to enhance the THz emission efficiency from different materials. The tabletop laser driven sources can be scaled to increase the emitted THz intensity, however, there seems to be an intrinsic limit up to which one can increase THz power. Many attempts have been made using different materials to find efficient THz emitters and detectors , but the efficiency of THz emission has been limited. We have developed several different THz Spectroscopy setups to investigate Metamaterials, Natural Materials and Biological Samples. We have studied Ga2O3 samples and many metamaterials using the home-built Near Field THz Microscope. We will give an overview of our THz activities and studies of various Materials.

## INVITED TALK-47:

## Toroidal resonances in terahertz meta-surfaces

Prof. Gagan Kumar (IIT Guwahati)

**Abstract:** The quest to develop low-loss photonic devices has led researchers to look for a new kind of electromagnetic excitation, known as toroidal resonances [1]. Toroidal excitation, possessing high-quality factor and narrow linewidth of the resonances, has found profound applications with the advent of metamaterials [2]. I shall discuss the excitation, properties and identification of toroidal resonances in planar metasurfaces, and various potential applications at terahertz frequencies. The applications include single and multiband electromagnetically induced transparency (EIT) effects in strongly coupled toroidal-dipole resonators [3], broadband polarization conversion [4], cross-polarization conversion, and logic gate operations. Recent research results through theory, numerical simulations and experiment conducted in our lab on the excitation of toroidal resonances and applications will be presented.

**References**

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[4]. R Sarkar, A Bhattacharya, A Punjal, SS Prabhu, G Kumar, Broadband terahertz polarization conversion using a planar toroidal metamaterial, Journal of Applied Physics 132 (18), 183103 (2022).

**Bio**:

Dr. Gagan Kumar received his Ph.D. degree from the Indian Institute of Technology Delhi, India in 2008 and is currently working as a Professor of Physics at IIT Guwahati. He joined IIT Guwahati in 2013 and served as an Assistant Professor of Physics from 2013 to 2018, and Associate Professor of Physics from 2018 to 2023 at IIT Guwahati. He was a postdoctoral researcher from 2008 to 2010 at the University of Utah, USA and postdoctoral Research Associate from 2010 to 2013 at the University of Maryland, College Park, USA. His primary research focus has been to investigate the terahertz plasmonic waveguides and metamaterials. He was selected for the award of Ramanujan fellowship and received the Young Scientist Research Award of DAE in 2015, respectively. He is currently working on several projects funded from different funding agencies. He is a member of several scientific societies including the senior member of the IEEE and the Optica.

## INVITED TALK-48:

## Magnetically controlled terahertz superlattice metasurfaces

Prof. Dibakar Roy Chowdhury (Mahindra University, Hyderabad)

**Abstract:** Over the past decades, subwavelength plasmonic metamaterial devices have drawn significant research interests because of its operational proficiency below diffraction limit, large energy confinement capability within a very small volume and ability to realize several exotic phenomena, which were not viable using other conventional photonic devices [1 – 3]. However, applications of such plasmonic metamaterials are usually hindered due to its associated large amount of plasmonic or ohmic (Joule) losses, which is so inherent that cannot be decoupled from such devices [3, 4]. To get rid of such losses, metal thickness needs to be reduced, preferably below the skin depth of constituent metals (optically thin structures). However, metamaterial responses are highly dependent on skin-depth of its constituent metals (its resonances are depleted if metal thickness decreases significantly below its skin-depth, around hundreds of nm at 1 THz) [5]. Therefore, to increase the metal conductivity, the multilayer systems derived from ferromagnetic (FM) and nonmagnetic (NM) materials showcased significant improvement in the conductivity under the applied magnetic fields [5, 6, 7], such phenomenon is known as giant magneto-transport (GMR) effect. Thus, inducing GMR concept into metamaterial domains by replacing typical single metal-based resonators with FM/NM superlattice resonators can lead to a unique concept of magnetically reconfigurable metamaterials. In this context, recent advancements in Al/Ni multilayer based THz metamaterials operating at resonances has demonstrated non-contact sensing of low-intensity magnetic fields [8]. In this work, we have investigated four layered (having 40 nm thickness) superlattice based THz metasurfaces (as shown in Fig. 1(a)), where films consist of periodic arrangement of FM (Ni) and NM (Al) metals (illustrated in Fig. 1(b)). We have examined structurally asymmetric metasurface configuration to observe two prominent phenomena: enhancement of metamaterial resonances with increasing applied magnetic field strength (in an optically thin sub-skin depth configuration) and excitation of Fano resonances by introducing structural asymmetry to eliminate radiation losses from the structure. Both dipole and Fano resonances are dynamically tuned by externally applied magnetic fields (around 0 to 30 mT), as depicted in Fig. 1(c)), respectively.

In another work, to investigate the role of the NM spacer layer thickness on the spin dependent scattering behaviour, we have studied five alternative layers of Al/Ni/Al/Ni/Al superlattice by varying the middle NM Al spacer layer thickness from 10 nm to 20 nm. We have demonstrated that for 10 nm spacer layer thickness the THz peak amplitude modulation is around 48% along with a significant relative modulation (~ 97%) in THz conductivities at 30 mT applied magnetic field. Therefore, we have demonstrated spin valve effect in Al/Ni multilayer plasmonic systems and magnetic modulation of Fano metamaterials to realize optically thin dynamically controllable THz meta devices, which should be extremely beneficial in versatile photonic as well as spintronic applications.

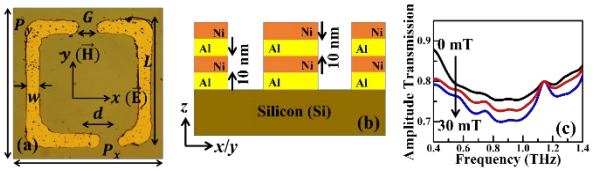


Fig. 1. (a) Optical microscope image of unit cell of fabricated metasurface, where resonators are made up of alternatively stacked thin (10 nm each) four layers of Al and Ni with structural parameters: periodicity $Px$=$Py$=70 $\mu m$, length and width of resonator ($L$,$w$)=(60,5) $\mu m$, asymmetry $d$=15 $\mu m$, width of split gap $G$=4 $\mu m$. (b) Schematic of x(y)-z cross-section of our proposed metasurface, illustrating the superlattice configuration. (c) Amplitude transmission spectra (experimentally obtained) obtained by varying B from 0 to 30 mT.

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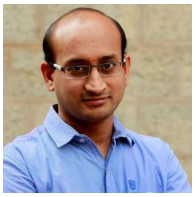
**Bio**: Dr. Dibakar Roy Chowdhary is currently Professor of Physics at Mahindra University. Currently, he is heading department of physics along with nanotechnology program in Mahindra University. Prof. Roy Chowdhury is a Ph.D from the Technical University of Darmstadt, Germany (2008). Post which he worked as a scientist at the University of Duisburg-Essen, Germany (2008 - 2009), Los Alamos National Laboratory (LANL), USA (2009 - 2013), and at the Australian National University (ANU), Australia (2013 - 2015) before joining Mahindra Ecole Centrale (now Mahindra University). His research encompasses designs, simulations, and fabrications of novel photonic devices while simultaneously exploring their applications in information, sensing, and energy-related fields. So far, he has published around 90 peer-reviewed papers in internationally reputed journals including Science, Applied Physics Letters, Advanced Optical Materials, Scientific Reports, Optics Express, Physical Review B, Optics Letters etc. His current h index is 31 with total citations more than 5000. His research has received coverage in the cover page of prestigious international journals, such as, Applied Physics Letters, Physica Status Solidi: RRL, Advanced Optical Materials and Journal of Applied Physics in past years.He is currently one of the editors of Optics Letters, a prestigious journal from Optica (formerly Optical Society of America, OSA). He is also a Fellow of the Institute of Physics (UK) (FInstP (UK)

**INVITED TALK-49:**



## High-Performance Optical Spectroscopy (HPOS) Technology

Prof. Sai Siva Gorthi (IISc Bengaluru)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