



Newsletter of the Physical Research Laboratory

THE SPECTRUM

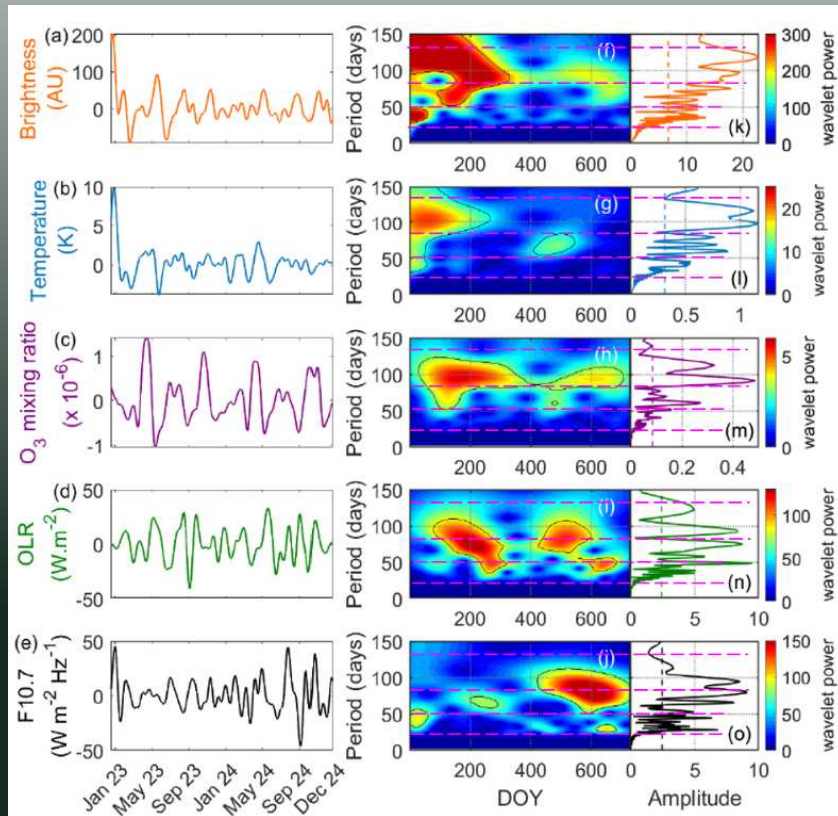


Image of the Month

ISO variability in (a) OH(3-1) nightglow brightness, (b) temperature, (c) mesospheric O₃, (d) OLR, and (e) F10.7 solar flux for 2023-2024. Panels (f-j) present the corresponding wavelet power spectra, with Lomb-Scargle spectral amplitudes for each parameter shown in panels (k-o), highlighting the statistically significant periodicities.

August 2026

Table of Contents

Superconducting Cooper pair formation in aperiodic binary systems.....	3
Distinct altitude-dependent responses of the ionospheric F-region during quiet-time TEC deviations over the EIA crest	4
Critical dynamics of the superfluid phase transition in model F.....	5
Unexpected fractional quantum Hall states in trilayer graphene.....	6
Inclusive Hadroproduction of X(3872), Xb and pentaquarks.....	7
Role of lower atmospheric and solar forcing in annual, semi-annual, and intraseasonal OH(3-1) brightness and temperature oscillations.....	8
Anomalous supercurrent in dissipative topological insulator-based Josephson junctions.....	9
Visit of Classes 9th – 12th students from Madhya Pradesh to PRL.....	10
FAR-SEE 2026 – Vikram Discussion on AI-ML.....	11
118th PRL Ka Amrut Vyakhyan.....	13
PRL Amrut Rajbhasha Vyakhyaan - 38.....	15
PRL Monthly Publications Digest.....	17
Awards & Honours.....	19
Visitors.....	19
New members.....	20
Obituary.....	28

Superconducting Cooper pair formation in aperiodic binary systems

The Author



**Sougata
Biswas**

(*Sougata Biswas, Debika Debnath, Paramita Dutta*)

The phenomenon of superconductivity is well explained by the formation and condensation of Cooper pairs. It has been studied in ordered and disordered systems in great detail, whereas systems that are neither completely ordered nor completely disordered remain largely unexplored although they host superconducting ground states. A theoretical study has been performed to explore the Cooper pair formation in quasiperiodic systems having long-range ordering in terms of order parameter and thermodynamic quantities. By systematically analyzing models, both one- and two-dimensional, generated through various growth rules, the influence of aperiodicity on the behavior of the order parameter that quantifies Cooper pair formation and how it evolves towards the periodic limit with the change in the structural pattern have been understood. The critical temperatures are largely affected by the aperiodicity and the parameter regime. The present analysis is useful to determine which quasiperiodic systems are most conducive to Cooper pair formation.

Source/Reference of the Work: <https://doi.org/10.1103/9trm-vbz9>

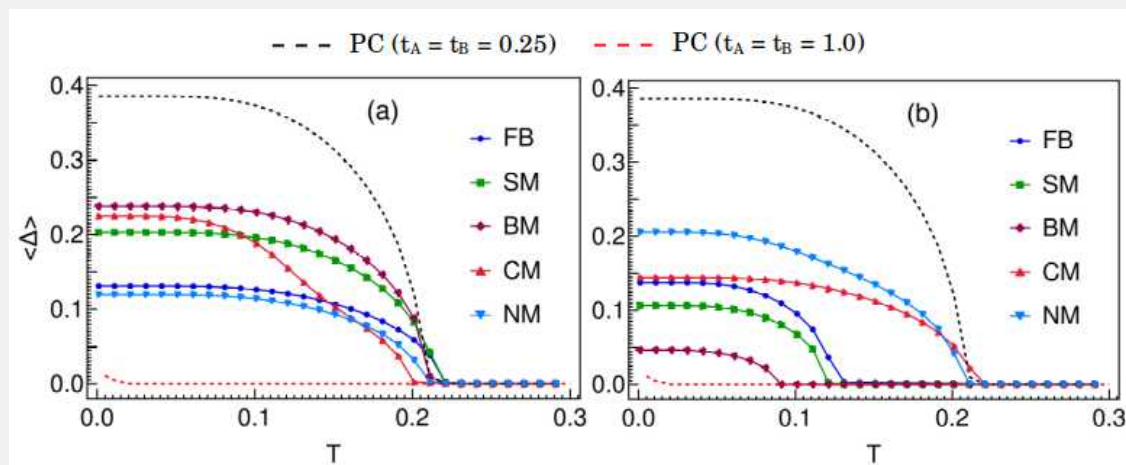


Figure Caption: (a-b) Variation of average superconducting order parameter with temperature in a range of aperiodic binary systems for two different parameter regimes. The abbreviations are as follows: FB: Fibonacci, SM: silver-mean, BM: bronze-mean, CM: copper-mean, NM: nickel-mean aperiodic binary sequence and PC: periodic chain.

The Author



Sandip Bhattacharyya

Distinct altitude-dependent responses of the ionospheric F-region during quiet-time TEC deviations over the EIA crest

(Sandip Bhattacharyya, K. Venkatesh, D. Pallamraju, D. Chakrabarty, H. Kava, and Gopi K Seemala)

The day-to-day variability of low-latitude ionospheric Total Electron Content (TEC) and F-layer structure is influenced by various drivers including electrodynamics, neutral dynamics and wave forcing from below. Understanding the relative role of various drivers is vital to characterize the ionospheric behaviour. In this study, day-to-day behaviour of ionospheric F-layer, including critical frequency (f_oF_2), peak height (h_mF_2), and base height ($h'F$), is investigated during pronounced quiet-time TEC enhancements and decrements. This study utilizes collocated ground-based digisonde and GPS-TEC observations over Ahmedabad during the years 2015 and 2017. Significant enhancements and decrements of approximately 35–70% in TEC and 25–65% in f_oF_2 are observed relative to the monthly mean variations under quiet geomagnetic conditions. Based on the relative behaviour of h_mF_2 and $h'F$, the identified events are classified into three categories: (i) F-layer expansion, (ii) F-layer compression, and (iii) uplift or descent of the entire F-layer. Figure 1 illustrates three distinct categories of the F-layer behaviour using day-to-day altitude profiles of critical frequency. Further, dominant 2–5 day periodicities in day-to-day f_oF_2 variations are noted, which indicate modulation by planetary waves through vertical coupling. Analysis of Equatorial Electrojet (EEJ) variability further reveals the distinct behaviour of the F-layer under different dynamical conditions. During E-dominant events, f_oF_2 variations closely follow EEJ changes, with electron density variability confined above ~ 300 km near the F-layer peak, indicating electrodynamic control through planetary wave-modulated zonal winds. In contrast, E-dormant events show no significant associations with EEJ variations, while electron density variability extends throughout the F-layer down to ~ 200 km, suggesting modulation by planetary wave-driven meridional winds. These results provide newer insights on the forcing from below, linking the wave-driven vertical coupling processes to altitude-dependent behaviour of quiet-time F-layer and TEC.

Source/Reference of the Work: <https://doi.org/10.1016/j.asr.2026.07.083>

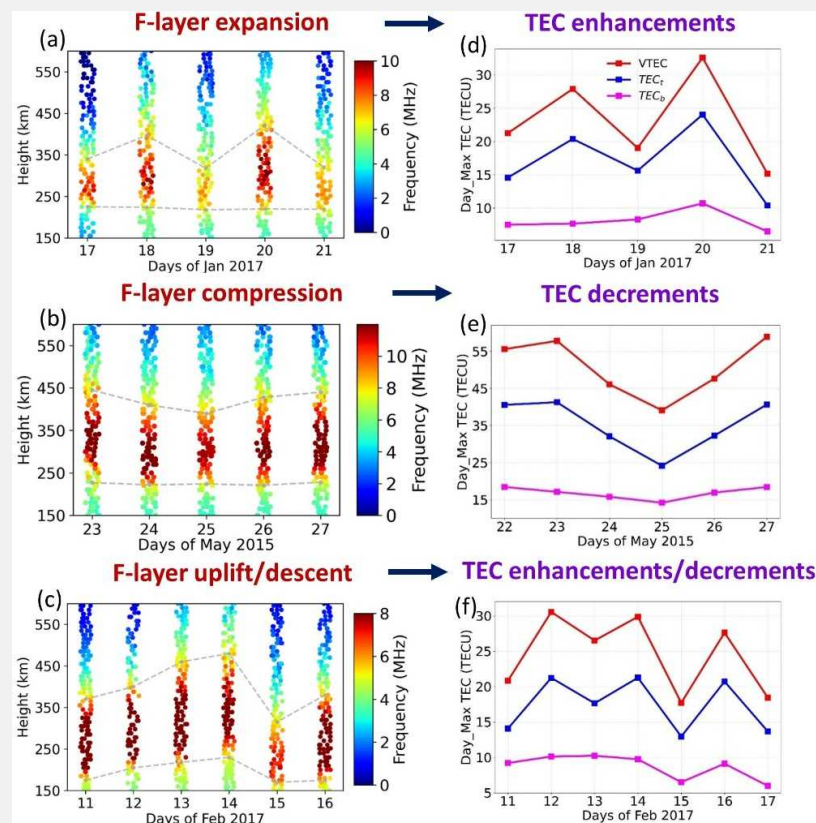


Figure Caption: (a)–(c) represent F-layer expansion, compression, and uplift/descent, respectively. (d)–(f) show corresponding day-to-day variations of the day maximum VTEC, TECb, and TECt for expansion, compression, and uplift/descent, respectively.

The Author



**Chandroday
Chattopadhyay**

Critical dynamics of the superfluid phase transition in model F

(**Chandroday Chattopadhyay**, Robert Maguire, Josh Ott, Thomas Schaefer, Vladimir V. Skokov)

Superfluids are remarkable states of matter that flow without friction. They occur in systems such as liquid helium, ultra-cold atomic gases, and may also exist in extremely dense matter. A stochastic hydrodynamic framework called “Model F” describes how such systems behave near the transition to the superfluid state, where both thermal fluctuations and collective dynamics are important. In this work, a numerical framework based on Model F was developed by combining a Metropolis algorithm for the stochastic and dissipative dynamics, along with a deterministic treatment of the reversible dynamics. This approach preserves the correct equilibrium distribution while providing a stable solution of the non-linear stochastic equations. The simulations successfully reproduced the expected dynamical scaling behavior near the critical point. They also captured the emergence of “second sound”, a wave-like mode in which heat propagates through a superfluid rather than simply diffusing. In addition the second sound diffusivity was shown to exhibit the theoretically predicted critical scaling with system size. These results provide a strong validation of the numerical framework and establish it as a reliable tool for studying critical dynamics in superfluids.

Source/Reference of the Work: <https://doi.org/10.1103/q49b-yygq>

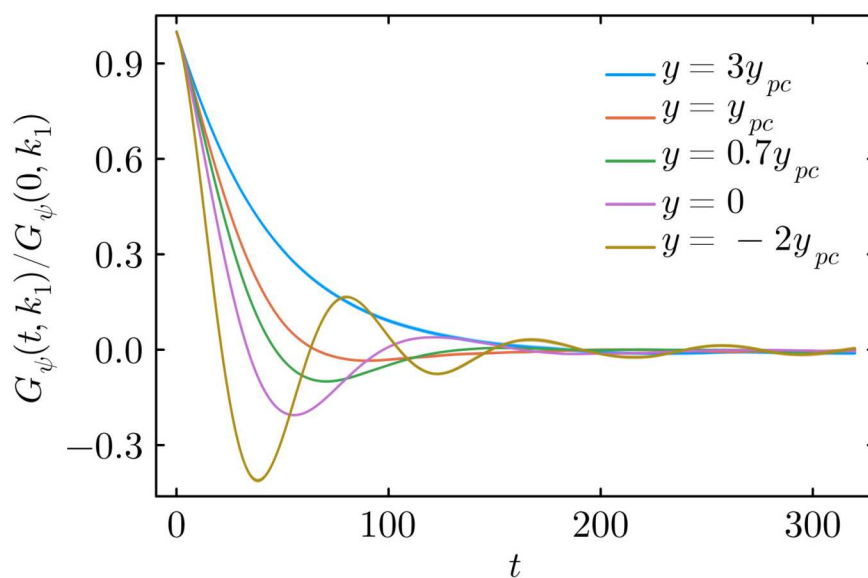


Figure Caption: Time evolution of the conserved-density correlation function for different temperatures across the superfluid phase transition. The crossover from monotonic decay in the normal phase to oscillatory relaxation in the superfluid phase demonstrates the emergence of “second-sound” modes.

Unexpected fractional quantum Hall states in trilayer graphene

The Author



Udit Khanna

(Tanima Chanda, Simrandeep Kaur, Harsimran Singh, Kenji Watanabe, Takashi Taniguchi, Manish Jain, **Udit Khanna**, Ajit C. Balram, Aveek Bid)

When a two-dimensional material is subjected to a strong magnetic field, the allowed energies of the electrons become quantized into discrete levels, known as Landau levels (LLs), which can host collective phases known as fractional quantum Hall (FQH) states. This work, performed in collaboration with IISc, Bengaluru and IMSc, Chennai, is a joint experimental and theoretical study of the quantum Hall regime in trilayer graphene. The experiments observed even-denominator FQH states in the zeroth LL of trilayer graphene. This observation is puzzling because such states are notably absent in comparable regimes of single and bilayer graphene, raising the question of why trilayer graphene behaves differently.

Our theoretical work proposes a mechanism for the emergence of these phases. The atomic structure of trilayer graphene differs from its single and bilayer variants in that it does not respect inversion symmetry. This permits additional short-range interactions that are absent in simpler graphene systems. Usually these additional interactions are too weak to have a major effect. However, when two LLs come close in energy, even weak interactions can strongly mix them. This mixing changes the effective interaction between electrons and can stabilize entirely new quantum Hall states.

Overall, the results provide theoretical support for the experimental observations and identify a mechanism by which weak lattice-scale interactions can lead to the emergence of new quantum phases in two-dimensional matter.

Source/Reference of the Work: <https://doi.org/10.1103/tsnc-4jjl>

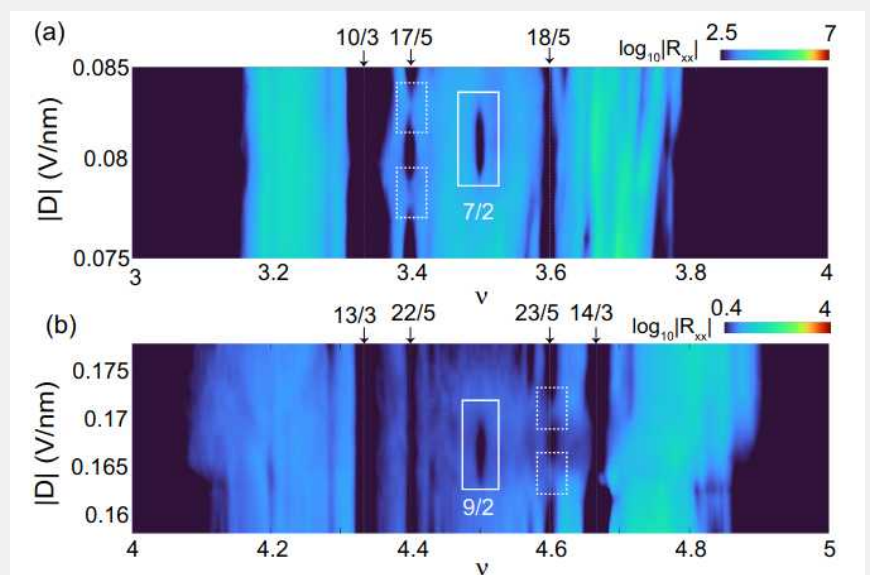
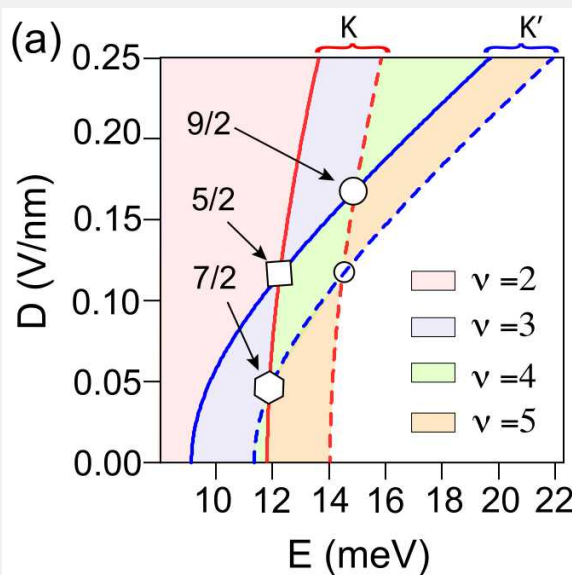


Figure Caption: (Left) Theoretical evolution of the LLs with displacement field (D) and energy (E). (Right) Measured resistance of trilayer graphene vs D and filling ν . The even denominator phases emerge in the regime where two zeroth LLs are expected to come close in energy.

Inclusive Hadroproduction of X(3872), Xb and pentaquarks

The Author



Abhishek Mohapatra

(Nora Brambilla, Mathias Butenschoen, Simon Hübner, **Abhishek Mohapatra**, Antonio Vairo, Xiangpeng Wang)

Recent years have witnessed the discovery of many exotic hadrons that challenge the traditional quark model of strongly interacting matter. In this work, the authors use the theoretical framework, known as Born–Oppenheimer Effective Field Theory (BOEFT) built from QCD based on symmetries and scale separations, to understand how such states are produced in high-energy proton–proton collisions at the Large Hadron Collider. The study focuses on the famous X(3872), one of the most intriguing exotic hadrons, as well as its predicted bottomonium counterpart Xb and hidden-charm and bottom pentaquarks. A central result of the work is the demonstration that the production mechanism is governed by the short-distance interaction of the heavy quark pair, which is created in a color-octet configuration. BOEFT separates this short-distance production process from the long-distance dynamics that bind the quarks into an observable hadron. The long-distance part is described through quantum-mechanical wave functions obtained by solving coupled Schrödinger equations constrained by QCD symmetries and lattice-QCD information on the potentials. Using this framework, the authors derive the production cross sections relevant for LHC experiments and provide quantitative predictions for the production of X(3872), Xb, and related pentaquark states. The analysis establishes a direct connection between QCD-based theory and measurable collider observables. Importantly, BOEFT does not assume in advance whether the X(3872) is a compact tetraquark or a loosely bound molecular state. Even though the particle appears large and molecule-like, its production is primarily governed by the short-distance interaction of the heavy quarks.

Source/Reference of the Work: [https://doi.org/10.1007/JHEP07\(2026\)260](https://doi.org/10.1007/JHEP07(2026)260)

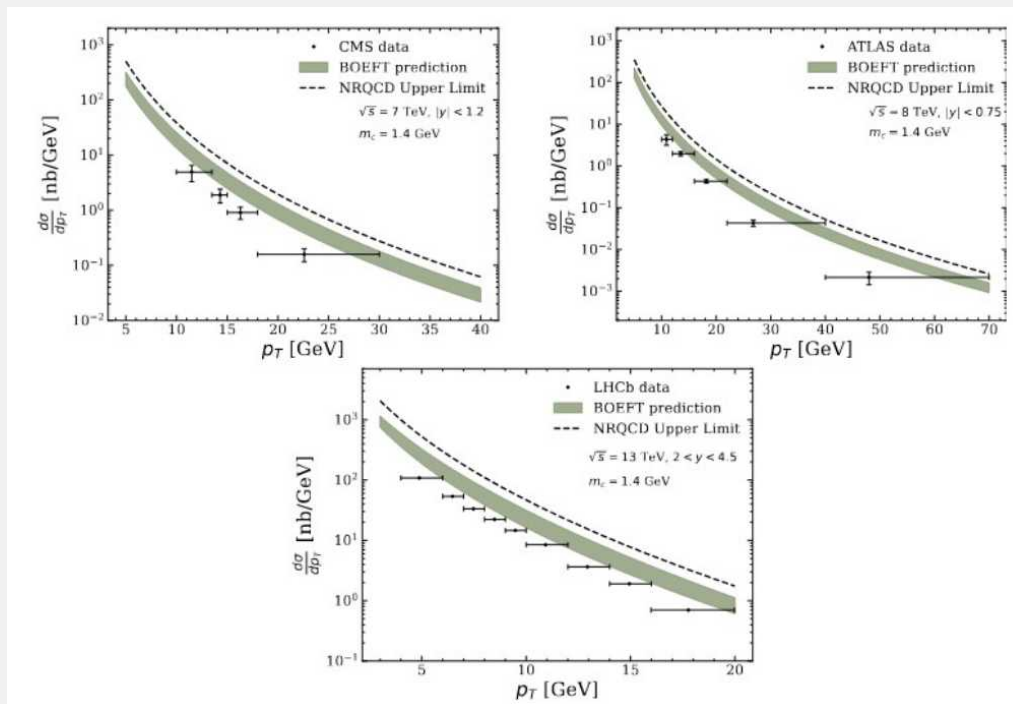


Figure Caption: Theoretical predictions for the prompt inclusive hadroproduction differential cross section of the X(3872) state compared with CMS data (upper-left panel), ATLAS data (upper-right panel) and LHCb data (lower panel). The region above the upper bound has been excluded from the bands in the plots, effectively reducing the uncertainties of the BOEFT predictions. The dashed lines represent the upper limits of the BOEFT predictions before implementing the upper bound.

The Author



Kiran

Role of lower atmospheric and solar forcing in annual, semi-annual, and intraseasonal OH(3-1) brightness and temperature oscillations

(Kiran, Ravindra P. Singh)

Annual (AO), semi-annual (SAO), and intraseasonal oscillations (ISOs) in the mesosphere and lower thermosphere (MLT) are investigated using two years (2023–2024) of OH(3–1) nightglow brightness and rotational temperature observations obtained from the PRL Airglow Infrared Spectrograph (PAIRS) over Ahmedabad (23°N, 72.6°E). Mesospheric ozone volume mixing ratio (O_3 VMR), outgoing longwave radiation (OLR), and F10.7 solar flux are incorporated to study the dominant causal mechanism responsible for the observed oscillations in MLT parameters. Lomb–Scargle periodogram analysis identifies prominent AO, SAO, and multiple ISO components, which are also present in mesospheric ozone volume mixing ratio (O_3 VMR), outgoing longwave radiation (OLR), and F10.7 solar flux. The temporal evolution of these oscillations are further examined using continuous wavelet transform and wavelet coherence (WTC) analyses. The results indicate that OH brightness and rotational temperature are influenced by different dynamical and radiative processes. OH brightness is characterized by SAO, consistent with the variations in O_3 VMR, OLR, and F10.7, whereas the temperature is primarily governed by the AO. The SAO in OH brightness remains in phase with O_3 VMR, indicating the direct influence of ozone photochemistry on OH brightness. The ISO activity exhibits significant interannual variability, with stronger oscillations during 2023 in all parameters except F10.7, which show enhanced ISO variability in 2024. Distinct ISO bands (20–50, 50–80, and 80–130 days) are observed. WTC analysis reveals that O_3 primarily drives the variability in OH brightness, whereas the combined influence of O_3 and F10.7 governs the temperature variability through solar-driven exothermic chemical reactions in the MLT region.

Source/Reference of the Work: <https://doi.org/10.1016/j.jastp.2026.106891>

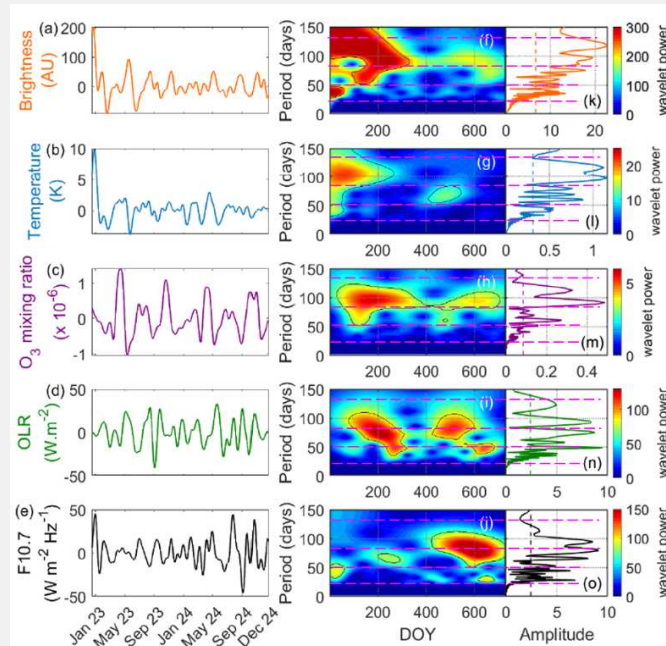


Figure Caption: ISO variability in (a) OH(3–1) nightglow brightness, (b) temperature, (c) mesospheric O_3 , (d) OLR, and (e) F10.7 solar flux for 2023–2024. Panels (f–j) present the corresponding wavelet power spectra, with Lomb–Scargle spectral amplitudes for each parameter shown in panels (k–o), highlighting the statistically significant periodicities.

Anomalous supercurrent in dissipative topological insulator-based Josephson junctions

(Ardamon Sten, **Paramita Dutta**, Sudeep Kumar Ghosh)

The Author



**Paramita
Dutta**

Understanding how quantum systems behave in presence of energy loss is essential for developing reliable quantum devices. Particularly, this effect on the superconductor-based heterostructures remained almost unexplored. In this work, how energy loss affects topological insulator-based superconductor junctions has been investigated. By introducing a controlled source of dissipation into a topological Josephson junction, the change in the behavior of the quantum states and its signatures in macroscopic behavior of the system has been studied. In particular, the characteristic zero-energy state shifts and becomes less robust, giving rise to finite lifetime to Majorana bound states. This dissipation also produces an unusual supercurrent that can flow even when there is no phase difference between the superconductors. The results of the present work reveal how dissipation fundamentally reshapes superconducting transport in topological junctions, opening new directions for dissipation-engineered quantum devices.

Source/Reference of the Work: <https://scipost.org/SciPostPhysCore.9.3.043>

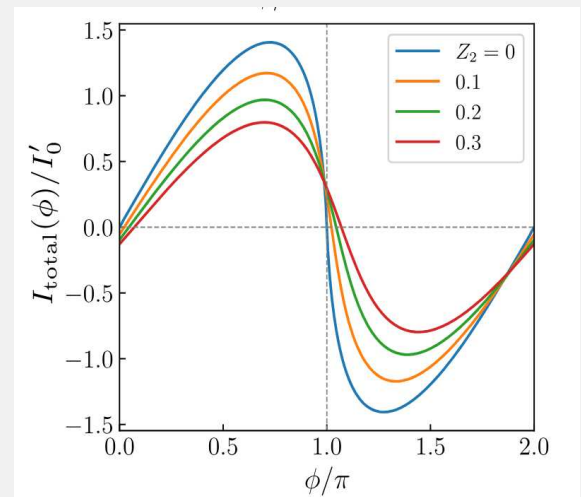
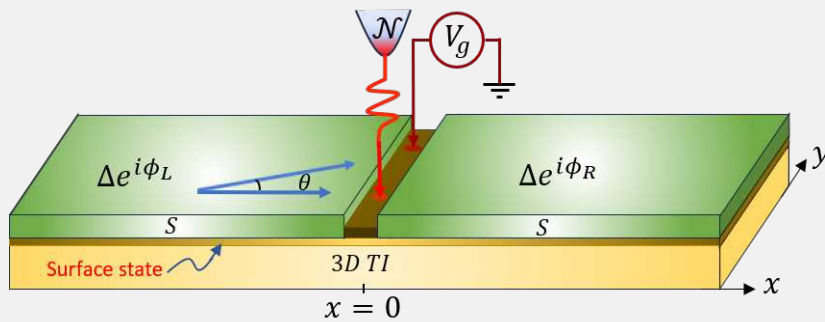


Figure Caption: (Left) Setup: A short junction is formed by placing two ordinary superconductors on top of a topological insulator. A top gate and lossy metallic lead are attached at the junction, where the gate modifies the potential barrier via voltage V_g and the lead introduces dissipation. (Right) Behavior of the supercurrent for various barrier strengths.

Visit of Classes 9th – 12th students from Madhya Pradesh to PRL

The students of Classes 9–12 from Madhya Pradesh, selected under the COSMIC STAR – SUPER 100 program, a collaborative initiative involving government, educational, and CSR partners, visited the Physical Research Laboratory (PRL), Ahmedabad on 14th July 2026. The visit began with a warm welcome by Prof. Goutam K. Samanta and Dr. Vishal Joshi, who introduced the students to the history of PRL and highlighted its significant contributions to scientific research. Subsequently, a documentary on PRL was screened to provide an overview of the institute's research activities.

The students then visited four laboratories at the PRL Thaltej campus: the Accelerator Mass Spectrometer (AMS) Facility, the Payloads Laboratory, the Simulation of Planetary Environments Exploration (SIMPEX), and the Astrochemistry Laboratory. At the AMS Facility, Mr. A. Shivam demonstrated the sophisticated instruments used for age determination through Accelerator Mass Spectrometry. Observing these advanced scientific instruments firsthand was an exciting and memorable experience for the students.



At the Payloads Laboratory, Mr. Vibhor Agrawal and Mr. Bhavesh Raj Singh Nehra delivered an informative presentation on ISRO's major space missions, including Chandrayaan and Mangalyaan. They also demonstrated various payload models, including the Vikram Lander and the Pragyan Rover. The students had the opportunity to observe lunar soil samples and a simulated Martian surface.

At the SIMPEX Laboratory, Ms. Ambily G. and Dr. Samadhanam Raju demonstrated a vacuum chamber capable of recreating the extremely low-pressure conditions found on the Moon. They explained how such facilities enable scientists to perform experiments under simulated lunar conditions without actually traveling to the Moon. Finally, the students visited the Astrochemistry Laboratory, where Prof. Bhalamurugan demonstrated the High Impact Shock Tube Apparatus (HISTA), which is used to study the behaviour of molecules under extreme temperature and pressure conditions generated by shock waves. The students also explored SALT, an experimental setup designed to investigate the behaviour of molecules on planetary surfaces under low-temperature conditions.

The laboratory visits were coordinated by Mr. Ashish Sengar, who guided the students throughout the event and ensured a smooth, engaging, and enriching experience for all participants.

FAR-SEE 2026 – Vikram Discussion on AI-ML

Frontiers of AI Research in Space, Earth System & Engineering Sciences (FAR-SEE) 2026 was held at PRL Ahmedabad on 20–21 July 2026 as a two-day Vikram Discussion on AI and machine learning, with PRL participants in the KRR Auditorium and external speakers joining online. It was conceived by the Director, Prof. Anil Bhardwaj, and developed under the mentorship of Prof. Partha Konar. The name carries a deliberate double meaning: an acronym for Frontiers of AI Research in Space, Earth System and Engineering Sciences, and a statement of intent, that AI when used carefully, enables us to see farther into the data we already hold.

Four objectives shaped the programme: to take stock of the AI/ML work already spread across PRL's divisions, much of it until now confined to individual groups; to build awareness among colleagues working in fields where these methods are still unfamiliar; to show the wider community what the laboratory itself is contributing; and to open collaborations with academia and industry.

Programme and participation

The Director's inaugural address placed the discussion squarely within PRL's scientific mission, making the case that AI is no longer a specialist's tool but a general-purpose instrument the laboratory must actively use. Prof. Ajit Kembhavi (IUCAA, Pune) then opened the scientific programme with a wide-angle keynote on AI across science and engineering, and Prof. Amit Sheth (NCR Chair and founding director of the AI Institute of South Carolina, USA, and founding director of IAIRO, India) closed it with a colloquium on reliable, explainable and safe neurosymbolic AI. In between came 28 invited talks across four themes, with speakers drawn from industry and applied-AI organisations as well as academia, among them IAIRO, Google DeepMind, IBM, C-DAC, Korza and Celonis.

 Participation		 Programme		 Talks by theme	
 PRL	119 (32.1%)	 Talks delivered	30	 1 Earth System Intelligence	5
 India, external institutions	239 (64.4%)	 Distinct speakers	32	 2 Sensing Beyond Boundaries	10
 Abroad (7 countries)	13 (3.5%)	 Invited talks	28	 3 Theory Meets Computation	6
 Total registrations	371	 Keynote + colloquium	2	 4 Autonomous, Resilient & Secure AI	8

Registrations spanned IITs, IISc and the IISERs, NITs, central and state universities, ISRO and Department of Space centres, national laboratories, industry and startups, and participants from seven countries across five continents.

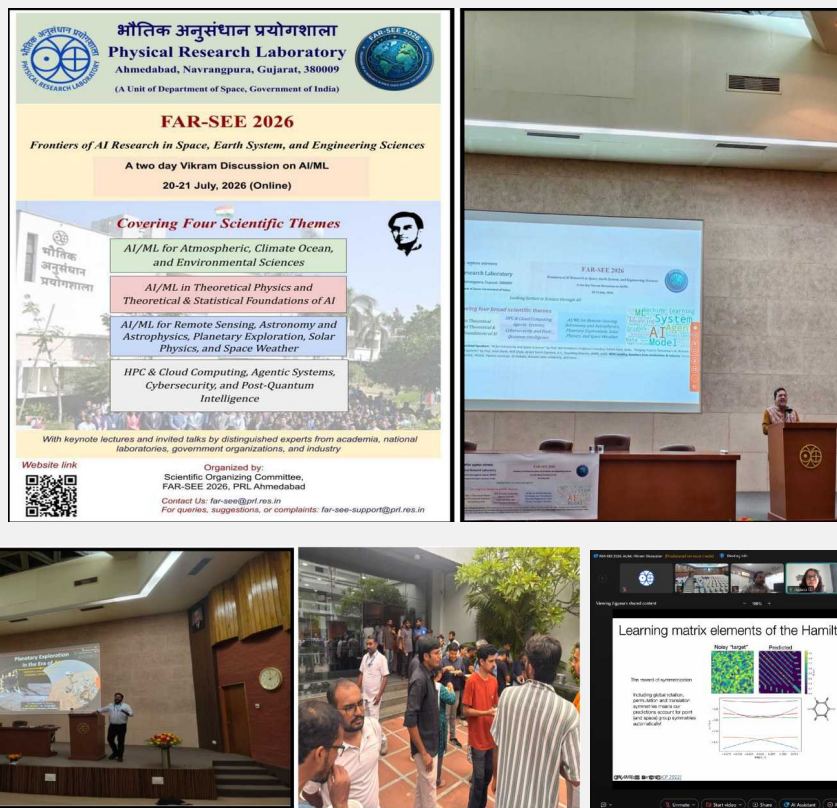
Outcome

A few threads ran consistently through the four themes. The clearest was a shift from prediction towards

explainability, with attribution and saliency methods used to recover physical mechanism rather than only to forecast — a demand that surfaced not just in the theory sessions but in the earth-system and sensing talks, where raw accuracy might have been expected to dominate. The second was the arrival of foundation models and transformer architectures in solar physics, planetary science and weather prediction, domains that had not previously used them. The third was the maturing of physics-informed and hybrid methods, where domain knowledge is built into the learning system rather than discarded. The individual results — sharper reconstructions of ocean carbon fields, thermoelectric materials predicted computationally and later confirmed in the laboratory, near-perfect optical mode decoding through multimode fibre — mattered less in themselves than for what they shared: the gains came from coupling learning to physics, not from scale alone. A fourth thread, trust, robustness and governance, was brought into focus by Theme 4, whose expertise came largely from industry and applied-AI organisations rather than from within PRL — an honest indication of where in-house capability is thinnest.

Two things to carry forward

First, compute is the binding constraint. Both the multilingual government-rules assistant and the lunar crater-detection pipeline ran on PARAM Vikram 1000, and expanded high-performance and cloud computing capacity, together with the software practices to use it well, is a precondition for the laboratory's ambitions here rather than a peripheral IT matter. Second, the response to the meeting — 371 registrations reaching well beyond PRL, from established researchers to students meeting AI/ML for the first time — suggests it served a real need. We therefore propose that FAR-SEE be held annually, with progressively wider participation, so that PRL can track a fast-moving field, deepen the collaborations begun here, and grow the meeting into a recognised national forum.



Official Poster of FAR-SEE 2026 and Glimpses of the event

118th PRL Ka Amrut Vyakhyaan



The 118th PRL Ka Amrut Vyakhyaan was delivered by Prof. Ankur Sinha, Professor at the Indian Institute of Management Ahmedabad (IIMA), on 23 July 2026 at the K. R. Ramanathan Auditorium, PRL Main Campus. In his engaging lecture titled “AI for Societal Intelligence – Data and Decision Making in Complex Social Systems,” Prof. Sinha shared how Artificial Intelligence (AI), data science, and operations research are transforming the way we understand and address complex societal challenges.

Prof. Sinha began the vyakhyaan by highlighting that AI has the potential to go far beyond conventional technological applications. By integrating diverse data sources, including spatial and temporal information, satellite imagery, camera networks, and surveys, with machine learning, predictive analytics, and optimisation, AI can generate valuable societal intelligence. He explained how such an integrated approach can convert vast amounts of data into actionable insights for evidence-based governance, enabling better planning, resource allocation, risk management, and timely responses to emerging challenges. He illustrated these ideas through two compelling case studies.

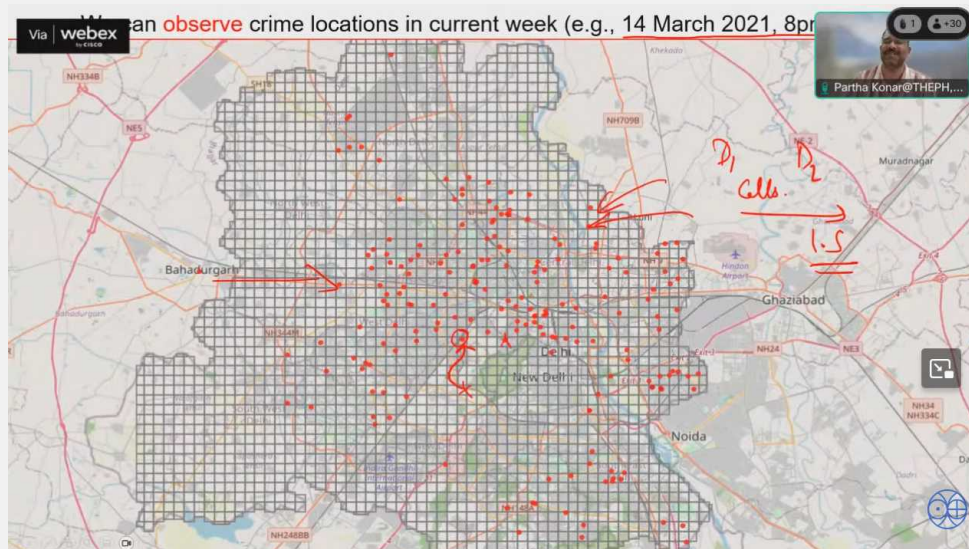
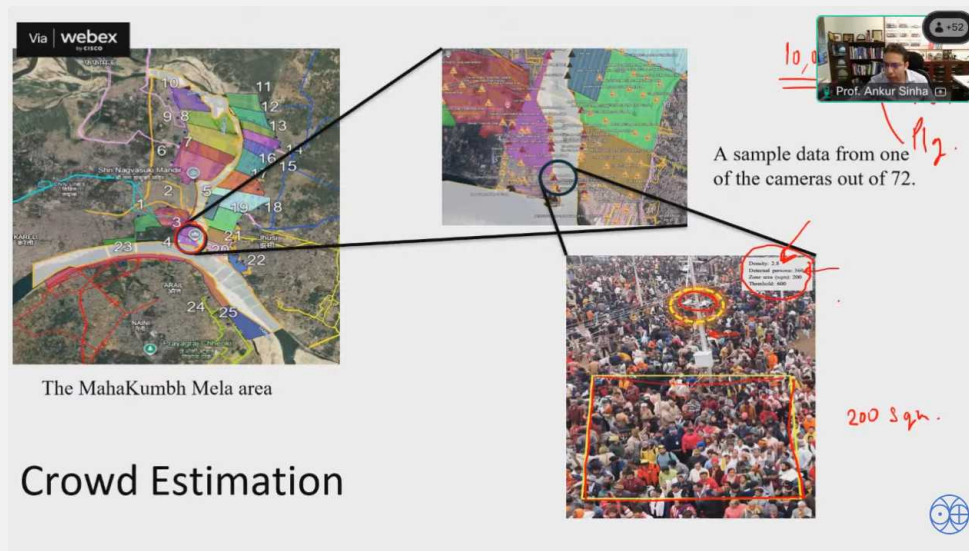
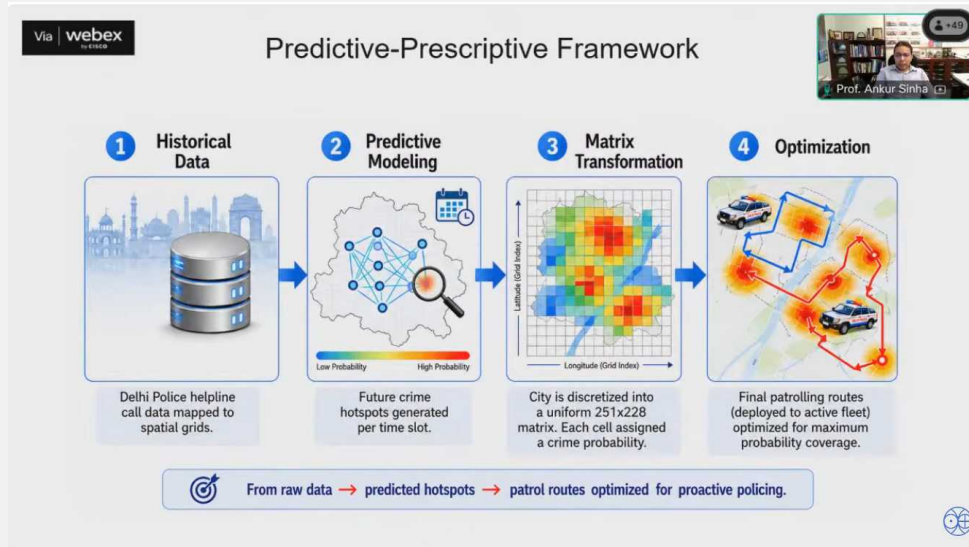
The first case study explored the Mahakumbh, one of the world's largest human gatherings, where satellite imagery, ground-based camera networks, surveys, and other data sources were combined with AI-based techniques to analyse crowd dynamics, mobility patterns, infrastructure utilisation, and socio-economic impact. The second case study presented an AI-powered crime prediction framework for an Indian metropolitan city, where spatio-temporal crime data were analysed using machine learning to identify crime hotspots. The predictions were further combined with optimisation techniques to improve police patrol allocation, demonstrating how AI can support a more proactive and data-driven approach to public safety.

Through these examples, Prof. Sinha showed how AI, predictive analytics, and optimisation can generate actionable intelligence for tackling complex societal challenges and support better planning, resource allocation, and decision-making. He also emphasised that AI for societal intelligence requires an interdisciplinary approach that combines data, computational methods, domain knowledge, predictive modelling, optimisation, and decision-making, rather than relying on algorithms alone. He highlighted its growing potential in public policy, urban planning, infrastructure development, governance, and risk management, enabling decision-makers to identify patterns, anticipate challenges, and make more informed decisions.

Overall, the 118th PRL Ka Amrut Vyakhyaan offered an engaging perspective on how AI can evolve from a technological capability into a powerful tool for societal benefit and public welfare.

Youtube Link:

<https://www.youtube.com/live/NOTv31A4JGU>



Glimpses of the event

PRL Amrut Rajbhasha Vyakhyaan - 38



"पीआरएल अमृत राजभाषा व्याख्यान (पर्व)" का 38वां व्याख्यान 29 जुलाई, 2026 को आयोजित किया गया था। इस अवसर के मुख्य वक्ता श्री आशु डालमिया, एडवोकेट, संस्थापक, एडीए लॉ चैंबर्स, अधिवक्ता, पूर्व चार्टर्ड अकाउंटेंट थे।

The 38th lecture of "PRL Amrut Rajbhasha Vyakhyaan (PARV)" was held on July 29, 2026. The eminent speaker for the occasion was Shri. Ashu Dalmia, Advocate; Founder, ADA Law Chambers; Advocate; Former Chartered Accountant.

श्री आशु डालमिया 'ADA लॉ चैंबर' के एडिटर, एक वकील और पूर्व चार्टर्ड अकाउंटेंट हैं। उन्हें टैक्स, कानूनी मामलों (लिटिगेशन), कॉर्पोरेट एडवाइज़री और विवाद समाधान के क्षेत्रों में दो दशकों का अनुभव है। श्री डालमिया 'इंस्टीट्यूट ऑफ चार्टर्ड अकाउंटेंट्स ऑफ़ इंडिया' (ICAI) की इन्डायरेक्ट टैक्सेस कमिटी (2018–19) में विशेष आमंत्रित सदस्य रहे हैं और उन्होंने ICAI तथा अन्य प्रमुख प्रोफेशनल संस्थाओं में एक प्रतिष्ठित संकाय सदस्य के रूप में काम किया है।

Mr. Ashu Dalmia is the Editor of ADA Law Chamber, an advocate and a former Chartered Accountant, with experience spanning two decades in matters of taxation, litigation, corporate advisory and dispute resolution. Mr. Dalmia has been associated with the Institute of Chartered Accountants of India as an invited member of the Indirect Taxes Committee (2018–19) and has served as an elected faculty member in ICAI and other leading professional bodies.

व्याख्यान का शीर्षक था/ The vyakhyaan was titled "गुड्स एंड सर्विसेज टैक्स (जीएसटी): भारत की अर्ध-संघीय वित्तीय व्यवस्था में स्वतंत्रता के बाद का एक ऐतिहासिक सुधार"

श्री डालमिया ने बताया कि 1 जुलाई, 2017 को लागू हुआ गुड्स एंड सर्विसेज टैक्स (GST) आज़ाद भारत के सबसे अहम आर्थिक सुधारों में से एक है। भारतीय संविधान की अर्ध-संघीय संरचना के भीतर, विशेष रूप से अनुच्छेद 245 के तहत विधायी शक्तियों के वितरण और अनुच्छेद 246A के तहत समवर्ती कराधान प्राधिकार के माध्यम से, जीएसटी ने केंद्र और राज्यों दोनों के लिए अप्रत्यक्ष कर प्रणाली को नया रूप प्रदान किया है। जीएसटी से पहले केंद्र द्वारा सेंट्रल एक्साइज ड्यूटी और सर्विस टैक्स जैसे कर वसूले जाते थे, जबकि राज्य वैल्यू एडेड टैक्स (वैट), सेंट्रल सेल्स टैक्स, लग्जरी टैक्स, एंटरटेनमेंट टैक्स, एंटी टैक्स तथा अन्य कई करों का संग्रह करते थे। जीएसटी ने इन बहुविध अप्रत्यक्ष करों को एकीकृत, गंतव्य-आधारित प्रणाली में समाहित कर दिया, जिससे केंद्र और राज्य एक साथ करों का संग्रह कर सकें।

Mr. Dalmia emphasized that the Goods and Services Tax (GST), implemented on July 1, 2017, stands as one of the most significant fiscal reforms in independent India. Within the quasi-federal structure of the Indian Constitution—specifically through the distribution of legislative powers under Article 245 and concurrent taxation authority under Article 246A—GST has reshaped the indirect tax system for both the Centre and the states. Prior to GST, the Centre levied taxes such as Central Excise Duty and Service Tax, while states collected Value Added Tax (VAT), Central Sales Tax, luxury tax, entertainment tax, entry tax, and various other levies. GST subsumed these multiple indirect taxes into a unified, destination-based system, enabling the Centre and states to collect taxes concurrently.

व्याख्यान में इस बात प्रकाश डाला गया कि भारतीय मॉडल की भारतीय मॉडल की एक विशिष्ट विशेषता संविधान के अनुच्छेद 279A के अंतर्गत गठित

जीएसटी परिषद है। संघ और सभी राज्यों का प्रतिनिधित्व करने वाली यह संवैधानिक संस्था दरों, नियमों और प्रक्रियाओं को निर्धारित करने में सर्वोच्च अधिकार रखती है, जिससे सहकारी संघवाद को मजबूती मिली है। हालांकि कई देशों में वैल्यू एडेड टैक्स (वैट) या जीएसटी प्रणाली मौजूद है, जैसे यूरोपीय संघ और ऑस्ट्रेलिया भारत का जीएसटी अपने पैमाने, द्वैत संरचना और एकीकृत राष्ट्रीय शासन के कारण अद्वितीय है।

The Vyakhyaan highlighted that a distinctive feature of the Indian model is the GST Council, constituted under Article 279A of the Constitution. Representing both the Union and all the states, this constitutional body holds supreme authority in determining rates, rules, and procedures, thereby strengthening cooperative federalism. Although Value Added Tax (VAT) or GST systems exist in many countries—such as the European Union and Australia—India's GST is unique due to its scale, dual structure, and unified national governance.

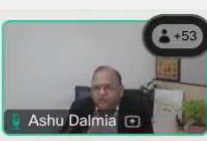
व्याख्यान के बाद एक रोचक प्रश्नोत्तर सत्र हुआ, जिससे श्रोताओं को विषय के बारे में नई और अधिक जानकारी प्राप्त हुई।

Following the lecture, an engaging question-and-answer session was held, which provided the audience with fresh insights and a deeper understanding of the subject.

Youtube Link: <https://www.youtube.com/watch?v=TBsiwzQIsqM>



Via **webex**





Income Tax Department Emblem & Motto

कोष मूलो दण्डः

Kosha Moolo Dandah — "The treasury is the root of the government"

- **Official Emblem:** The Income Tax Department adopted Kautilya's maxim as its motto – a 2,300-year-old principle of statecraft now emblazoned on the emblem of a modern tax authority
- **Continuity of Thought:** From Kautilya's palace scribes to the GST portal recording every invoice electronically – the principle of transparent, accountable tax administration has never changed
- **The Bee Principle in Practice:** The emblem is a daily reminder that the power to tax must be exercised with restraint, certainty, and proper record-keeping



PRL Monthly Publications Digest

Total Publications in July 2026: 22.

Atomic, Molecular and Optical Physics [4]

1. Pranav Bhardwaj, P Madhusudhan, Vinitha Nimma, Sonali Panda, Indrajit Kabiraj, Pooja Chandravanshi and Rajesh Kumar Kushawaha, 2026, Two-color high harmonic generation apparatus: effects of pressure, power, and delay on the high-harmonic yield, Journal of Physics B: Atomic, Molecular and Optical Physics, Date of Publication: 27/07/2026, Impact Factor: 1.7
2. S. Caliskan, A. M. Amarsi, P. Jönsson, N. Grevesse and B. K. Sahoo, 2026, Ag I model atom and the 3D non-LTE solar silver abundance, Astronomy & Astrophysics 711, A155 (2026), Date of Publication: 17/07/2026, Impact Factor: 6.1
3. Indrajit Kabiraj, Sonali Panda, Km Akanksha Dubey, Vinitha Nimma, Pooja Chandravanshi and Rajesh Kumar Kushawaha, 2026, High harmonic generation driven by complex two-color laser fields with variable relative polarization, Journal of Physics B: Atomic, Molecular and Optical Physics, Date of Publication: 16/07/2026, Impact Factor: 1.7
4. Satoshi Toda, Yasuto Masuda, Naohiro Tomiyama, Kota Yanase, Bijaya Kumar Sahoo, Masahiko Hada, and Minoru Abe, 2026, Analytical representation for the electronic contribution of the nuclear Schiff interaction Hamiltonian, Molecular Physics, Date of Publication: 02/07/2026, Impact Factor: 1.8

Astronomy & Astrophysics Division [2]

1. Federica Rescigno , Manu Stalport , Ancy Anna John , Tiger Lu , Daisy A Turner , Lorena Acuña-Aguirre , Anand Bhongade , Anjali A A Piette , Vedad Kunovac , Michael Cretignier , Andrew Vanderburg , Ken Rice , Annelies Mortier , Rishikesh Sharma , Guillaume Hébrard , Abhijit Chakraborty , Alessandro Sozzetti , Andrew Collier Cameron , Pía Cortés-Zuleta , Rosario Cosentino , Florian Destrieux , Mercedes López-Morales , Luca Malavolta , Jesús Maldonado , Giacomo Mantovan , Francesco Pepe , Matteo Pinamonti , André M Silva , Stephane Udry , Shreyas Vissapragada , Thomas G Wilson, 2026, Understanding eccentric temperate giants: an in-depth study of the architecture and stellar obliquity of the TOI-2134 system, Monthly Notices of the Royal Astronomical Society, Date of Publication: 17/07/2026, Impact Factor: 5.2
2. Sushant Dutta, Veeresh Singh, C H Ishwara Chandra, Yogesh Wadadekar, Russ Taylor, Mattia Vaccari, Lucia Marchetti, Matt Jarvis, Catherine Hale, Solohery Randriamampandry, Zara Randriamanakoto, 2026, SuperMIGHTEE : Spectral Ages of Remnant Radio Galaxy Candidates in the XMM-LSS Field, Monthly Notices of the Royal Astronomical Society, stag1328, Date of Publication: 14/07/2026, Impact Factor: 5.2

Planetary Sciences Division [3]

1. Pipasa Layak Nachiketa Rai Kuljeet Kaur Marhas Hilary Downes , 2026, Thermochemical evolution of the mesosiderite parent body: Modelling and mineralogical constraints on silicates, Geochemistry, Date of Publication: 16/07/2026, Impact Factor: 3.0
2. S. A. Haider, O. Korablev, J. Alday, A. Fedorova, D. A. Belyaev, S. Saxena, Gayatri J. Sharma, Siddhi Y. Shah, 2026, Impact of X-Rays (0.5Å–90Å) During GDS 2018 on the Production Rates of H₂O⁺, HDO⁺ and Electron Density in the D Region Ionosphere of Mars: First Ionospheric Modeling Based on ACS/MIR-NIR Observations From ExoMars/TGO, Journal of Geophysical Research: Planets, Date of Publication: 15/07/2026, Impact Factor: 3.7
3. Prince Kumar, Debkumar Chakraborty, Devendra Sharma, and S. K. Mishra, 2026, Obstacle driven fore-wake excitations in strongly coupled Yukawa fluids, Physics of Fluids, Date of Publication: 01/07/2026, Impact Factor: 3.8

Space & Atmospheric Sciences Division [6]

1. Rajesh, T.A., S. Ramachandran, and V.K. Dhaker, 2026, Insights into regional black carbon sources from site-specific absorption properties, Atmospheric Pollution Research, Date of Publication: 29/07/2026, Impact Factor: 3.9

2. S. Bhattacharyya, K. Venkatesh, Pallamraju, D., Chakrabarty, D., Kava, H., Seemala, G.K., , 2026, Distinct altitude-dependent responses of the ionospheric F-region during quiet-time TEC deviations over the EIA crest, *Advances in Space Research*, Date of Publication: 22/07/2026, Impact Factor: 3.2
3. Khonde, D., R.P. Singh, D. Pallamraju, P. Suryawanshi, 2026, MIGHTI Observations of Thermospheric O(D) Dayglow Emission and Its Comparison With the GLOW and WINDII Empirical Models, *Journal of Geophysical Research: Space Physics*, Date of Publication: 08/07/2026, Impact Factor: 3
4. Venkatesh, K, Pezzopane, M, 2026, Recent developments in equatorial, low- and mid-latitude mesosphere, thermosphere and ionosphere studies, *Advances in Space Research*, Date of Publication: 01/07/2026, Impact Factor: 3.2
5. Chougule, P., Shetti, D., Venkatesh, K., Seemala, G.K. and Chougule, S.,, 2026, A study of the Ionospheric response during intense geomagnetic storms over the Indian low-latitude region during the period 2017-2023, *Advances in Space Research*, Date of Publication: 01/07/2026, Impact Factor: 3.2
6. Ansari, K., Panda, S. K., Venkatesh, K. and Jamjareegulgarn, P., 2026, Ionospheric gradients in multi-constellation global navigation satellite system signals onboard UAV using GIM and Klobuchar model over Thailand region, *Advances in Space Research*, Date of Publication: 01/07/2026, Impact Factor: 3.2

Geosciences Division [1]

1. P A Janaarathan and Sanjeev Kumar, 2026, Can CO₂ outgassing and carbonate precipitation explain the Lomagundi Excursion?, *Geochemical Perspectives Letters*, Date of Publication: 31/07/2026, Impact Factor: 4.3

Theoretical Physics Division [5]

1. Nora Brambilla, Mathias Butenschoen, Simon Hibler, Abhishek Mohapatra, Antonio Vairo & Xiangpeng Wang , 2026, Inclusive hadroproduction of $\psi(3872)$, Xb and pentaquarks, *Journal of High Energy Physics*, Date of Publication: 28/07/2026, Impact Factor: 4.9
2. Ardamon Sten, Paramita Dutta and Sudeep Kumar Ghosh, 2026, Spectral bifurcation and anomalous supercurrent in dissipative topological insulator-based Josephson junctions, *SciPost Physics Core*, Date of Publication: 22/07/2026, Impact Factor: 3.4
3. Gurucharan Mohanta, Ketan M. Patel, 2026, Flavour hierarchies from radiative corrections in latticised theory space, *Journal of High Energy Physics*, Date of Publication: 16/07/2026, Impact Factor: 4.9
4. Tanima Chanda, Simrandeep Kaur, Harsimran Singh, Kenji Watanabe, Takashi Taniguchi, Manish Jain, Udit Khanna, Ajit C. Balram, and Aveek Bid, 2026, Even Denominator Fractional Quantum Hall States in the Zeroth Landau Level of ABA Trilayer Graphene, *Physical Review Letters*, Date of Publication: 15/07/2026, Impact Factor: 9.4
5. Sougata Biswas, Debika Debnath, and Paramita Dutta, 2026, Superconducting order parameter in aperiodic binary systems, *Physical Review B* 114, 024505 (2026), Date of Publication: 06/07/2026, Impact Factor: 3.9

Udaipur Solar Observatory [1]

1. Sandeep Kumar, Nandita Srivastava, and Dana-Camelia Talpeanu, 2026, Source Surface Height Optimization for Improved Solar Wind Velocity Forecasting across Solar Cycles 23, 24, and 25, *The Astrophysical Journal*, Date of Publication: 13/07/2026, Impact Factor: 5.7

Awards & Honours

- (1) Dr. Shubhra Sharma, Assistant Professor, Geosciences Division, Physical Research Laboratory (PRL), has been invited to join the Editorial Board of the Journal of Quaternary Advances (Elsevier).
- (2) Dr. Shashikiran Ganesh, Professor, Astronomy & Astrophysics Division, Physical Research Laboratory (PRL), has received recognition of his work by the IAU's Working Group on Small Bodies Nomenclature wherein an Asteroid (20712) 1999 XF13 is now named after him.
- (3) Dr. Vishal Joshi, Associate Professor, Astronomy & Astrophysics Division, Physical Research Laboratory (PRL), has been invited to serve as a member of the Academic Council at M. G. Science Institute.
- (4) Dr. Kavutarapu Venkatesh, Associate Professor, Space and Atmospheric Sciences Division, Physical Research Laboratory (PRL), has been selected as an Associated Editor for Advances in Space Research (ASR) journal for the stream "Earth Magnetosphere and Upper Atmosphere".
- (5) Prof. D. Pallam Raju, Senior Professor and Dean, PRL, has been elected as a Member (Academician) of International Academy of Astronautics (IAA), in Section 1 on Basic Sciences.

Visitors

1. A Ph.D. student from National Institute of Science Education & Research, Bhubaneswar visited Theoretical Physics Division of Physical Research Laboratory, Ahmedabad on 03.07.2026 and again during the period from 30.07.2026 to 31.07.2026 for research related discussion.
2. Mr. Gilles Alcaraz, Research Director, Director of the CNRS Officer in INDIA from Embassy of France in India, New Delhi visited Physical Research Laboratory, Ahmedabad on 23.07.2026 to meet the Director, PRL.
3. In July 2026, a total of One hundred and nine (109) personnel, including officials from DOS/ISRO, representatives from other Government Organizations, Students from various IITs and other Educational institutions, and the general public, visited the Infra-Red Observatory (IRO) at PRL in Mount Abu to explore its various scientific facilities.

Hearty welcome to our new members



Name: Mr. Pratham Gupta

Designation: Scientist/Engineer - SC

Date of Joining: 08-07-2026

Division: Astronomy & Astrophysics Division



Name: Mr. Shyoji Ram Meena

Designation: Technician-B

Date of Joining: 09-07-2026

Division: Workshop



Name: Mr. Narendra Parihar

Designation: Laboratory Assistant

Date of Joining: 13-07-2026

Division: Geosciences Division



Name: Ms. Aditi Pandey

Designation: Junior Research Fellow

Date of Joining: 13-07-2026

Division: Astronomy & Astrophysics Division



Name: Ms. Divya Singh

Designation: Junior Research Fellow

Date of Joining: 13-07-2026

Division: Geosciences Division



Name: Ms. Joshi Sanjana Samirbhai

Designation: Junior Research Fellow

Date of Joining: 14-07-2026

Division: Astronomy & Astrophysics Division



Name: Ms. Mansi

Designation: Junior Research Fellow

Date of Joining: 14-07-2026

Division: Astronomy & Astrophysics Division



Name: Ms. Anushka Verma

Designation: Junior Research Fellow

Date of Joining: 14-07-2026

Division: Atomic, Molecular & Optical Physics Division



Name: Mr. Hadi Muhammed Rahil KK

Designation: Junior Research Fellow

Date of Joining: 14-07-2026

Division: Geosciences Division



Name: Ms. Isha Pal

Designation: Junior Research Fellow

Date of Joining: 14-07-2026

Division: Geosciences Division



Name: Ms. Ananya Verma

Designation: Junior Research Fellow

Date of Joining: 14-07-2026

Division: Geosciences Division



Name: Ms. Parul Pramod Dhakate

Designation: Junior Research Fellow

Date of Joining: 14-07-2026

Division: Planetary Science Division



Name: Mr. Dilpreet Sandhu

Designation: Junior Research Fellow

Date of Joining: 14-07-2026

Division: Theoretical Physics Division



Name: Mr. Gaurank Yadav

Designation: Junior Research Fellow

Date of Joining: 15-07-2026

Division: Atomic, Molecular & Optical Physics Division



Name: Mr. Aditya Pratap Singh

Designation: Junior Research Fellow

Date of Joining: 15-07-2026

Division: Atomic, Molecular & Optical Physics Division



Name: Mr. Nikunj Dimri

Designation: Junior Research Fellow

Date of Joining: 15-07-2026

Division: Planetary Science Division

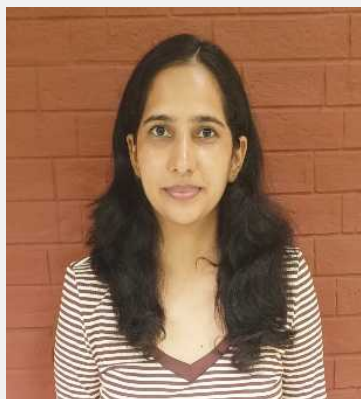


Name: Ms. Ishika Agarwal

Designation: Junior Research Fellow

Date of Joining: 15-07-2026

Division: Planetary Science Division



Name: Ms. Mausham

Designation: Junior Research Fellow

Date of Joining: 15-07-2026

Division: Space & Atmospheric Sciences Division



Name: Mr. Aishik Parna Borah

Designation: Junior Research Fellow

Date of Joining: 15-07-2026

Division: Space & Atmospheric Sciences Division



Name: Mr. Kunal Sharma

Designation: Junior Research Fellow

Date of Joining: 15-07-2026

Division: Atomic, Molecular & Optical Physics Division



Name: Mr. Himanshu Dhankar

Designation: Junior Research Fellow

Date of Joining: 15-07-2026

Division: Theoretical Physics Division



Name: Ms. Dimpal Sharma

Designation: Junior Research Fellow

Date of Joining: 20-07-2026

Division: Astronomy & Astrophysics Division



Name: Ms. Jaya Chowdhury

Designation: Junior Research Fellow

Date of Joining: 20-07-2026

Division: Astronomy & Astrophysics Division



Name: Mr. Vikas Rathour

Designation: Junior Research Fellow

Date of Joining: 20-07-2026

Division: Atomic, Molecular & Optical Physics



Name: Ms. Harshina Ayisha M V

Designation: Junior Research Fellow

Date of Joining: 20-07-2026

Division: Planetary Science Division



Name: Ms. Akhila G Nair

Designation: Junior Research Fellow

Date of Joining: 20-07-2026

Division: Theoretical Physics Division



Name: Mr. Raghav Prakash Sen

Designation: Junior Research Fellow

Date of Joining: 20-07-2026

Division: Geosciences Division



Name: Dr. Aindrila Mukherjee

Designation: Post Doctoral Fellow

Date of Joining: 20-07-2026

Division: Planetary Science Division



Name: Ms. Anshika Pandey

Designation: Post Doctoral Fellow

Date of Joining: 20-07-2026

Division: Planetary Science Division

Obituary



स्वर्गीय श्री सी. ए. गज्जर
Late Shri C. A. Gajjar
Technician-F1

Date of Birth: 02.10.1952

Date of Joining: 06.09.1976

Date of Retirement: 31.10.2012

Date of Death: 22.07.2026

Teary Eyes for our Departed Member

Compiled, Designed and Published by

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