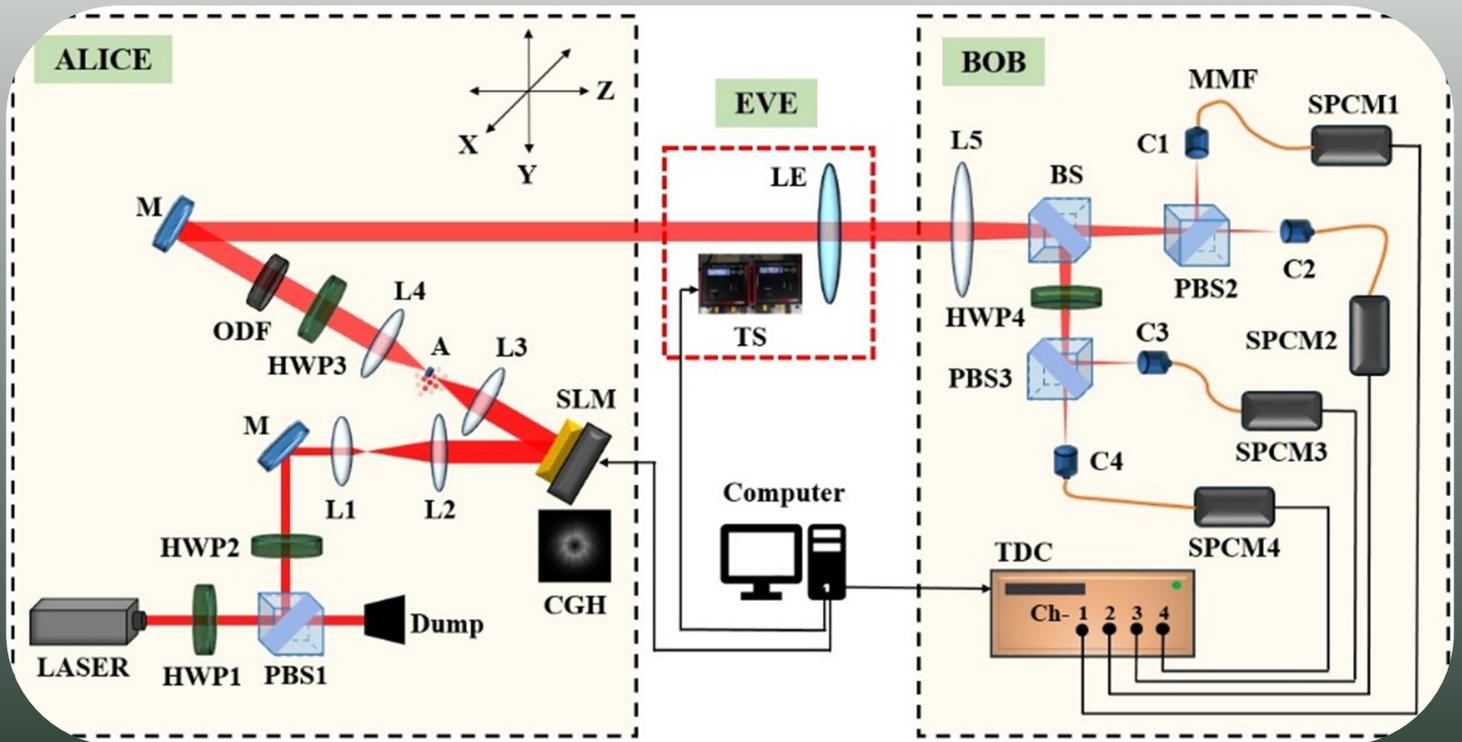




Newsletter of the Physical Research Laboratory

# THE SPECTRUM



## Image of the Month

Experimental setup used to implement the side-channel attack in the Quantum Science and Technology Laboratory (QST) at PRL

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## Signature of intraseasonal oscillations during Hunga Tonga volcanic eruption

(Ankita Chaurasia and Amitava Guharay)

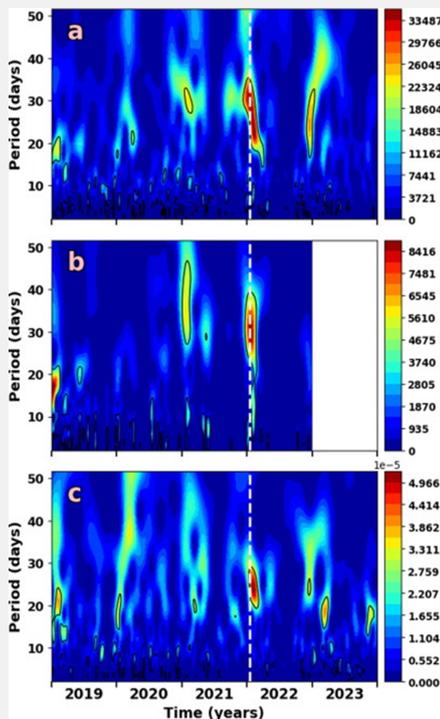
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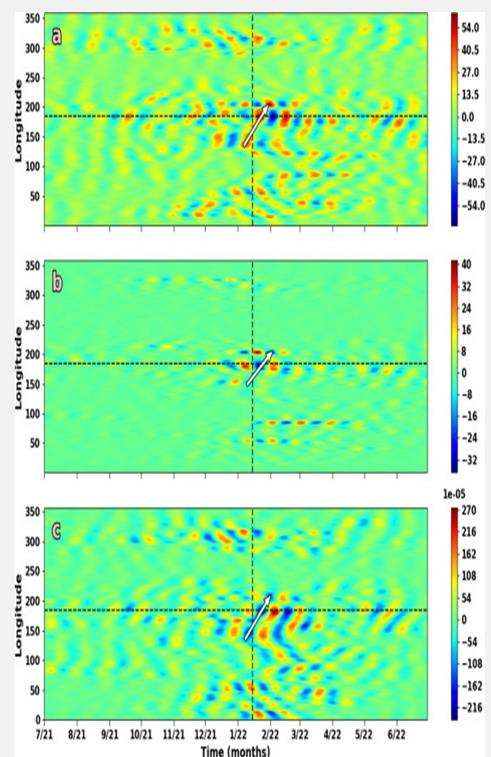
Ankita Chaurasia

The Hunga Tonga-Hunga Ha'apai (HTHH) volcanic eruption ( $20.536^{\circ}$  S,  $175.382^{\circ}$  W) on 15 January 2022 was one of the most powerful events ever recorded and generated a wide range of atmospheric disturbances. The present study investigates its impact on intraseasonal oscillations (ISO) using satellite and reanalysis data. Wavelet analysis (Figure 1) of Outgoing Longwave Radiation (OLR), precipitation (RF), and specific humidity (SH) at the eruption location shows enhanced intraseasonal variability in the 20–40-day period range during the volcanic event. Similar patterns are observed in the wavelet spectra of RF and SH, indicating a common dominant ISO band around the eruption time. A strong peak in the OLR wavelet spectrum within the ISO range suggests a significant role of convection in the observed variability. The release of large amounts of water vapour into the atmosphere likely enhanced cloud formation and rainfall, which in turn reduced the outgoing longwave radiation, highlighting the close connection between SH, RF, and OLR. Band-pass filtered results (Figure 2) reveal clear eastward phase propagation of ISO near the volcano location, with phase speeds of about 3.6 m/s, 2.8 m/s, and 3.7 m/s for OLR, RF, and SH, respectively. Strong ISO amplitudes are observed around and after the eruption, indicating a sustained atmospheric response. Overall, the results show that a major volcanic event can strongly influence intraseasonal variability and associated wave dynamics, providing useful insights into the coupling between convection, atmospheric waves, and extreme geophysical forcing, and adding to the limited existing literature on this topic.

**Source/Reference of the Work:** <https://doi.org/10.1016/j.asr.2025.12.072>



**Figure 1:** Wavelet power spectra of (a) OLR ( $W2m-4$ ), (b) RF ( $mm2day-2$ ), and (c) SH ( $kg2kg-2$  at 6 km). The time series spans from 2019 to 2023, with periods ranging from 2 to 50 days. Black curves in each plot represent 95% confidence level. Dashed white line marks the event day (15-January, 2022).

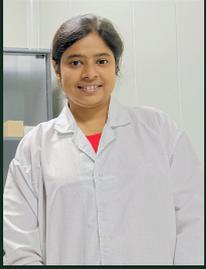


**Figure 2:** Filtered (a) OLR ( $Wm-2$ ), (b) RF ( $mmday-1$ ), and (c) SH ( $kgkg-1$  at 6 km), using a 20- 40 day band-pass. Time series (X-axis) spans from 01-July, 2021 to 30-June, 2022, and Y-axis represents longitudes from  $0^{\circ}$  to  $360^{\circ}$ . Dashed black vertical line marks the event day (15-January, 2022) and horizontal line the event longitude ( $185^{\circ}$ ).

## Impact of Atmospheric Turbulence on Spatial Mode Mismatch Attacks in Free-Space QKD Implementation

(Rachita Nandan, Tanya Sharma, R. P. Singh, Shashi Prabhakar)

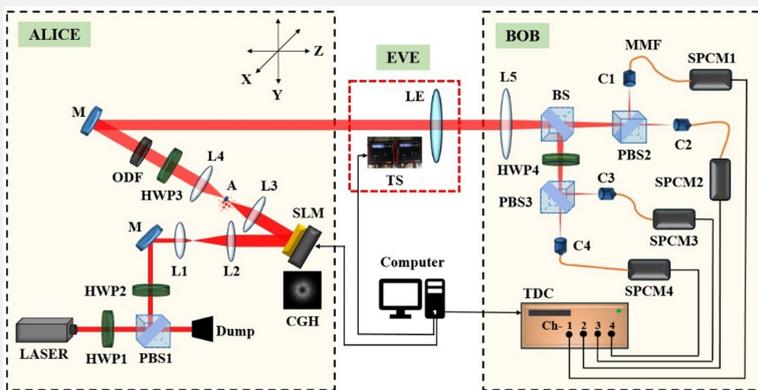
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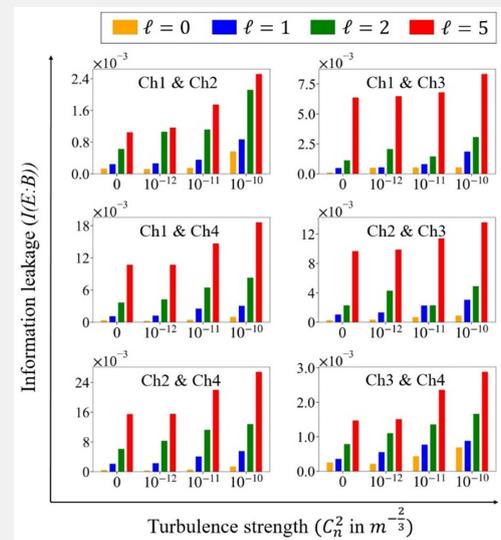
**Rachita Nandan**

As classical communication systems become increasingly vulnerable to security threats with advancing technology, quantum communication offers a fundamentally secure alternative. One of its most practical applications is quantum key distribution (QKD), which enables two distant users, commonly referred to as Alice and Bob, to share secret encryption keys using the quantum properties of light. Free-space QKD is especially promising for satellite-based and long-distance communication. However, when quantum signals (photons) propagate through the atmosphere, they are affected by turbulence, which distorts the light beam and causes fluctuations. These effects not only degrade signal quality but can also be exploited by an eavesdropper (Eve) through a ‘side-channel attack’, where Eve could exploit imperfections in the systems rather than breaking the quantum protocol itself. One such imperfection arises from mismatches in how the receiver detects light arriving from different angles. In this work, we experimentally (Figure 1) investigate how atmospheric turbulence impacts the security of BB84-based QKD systems by implementing a spatial mode-mismatch attack under simulated atmospheric turbulence conditions in the laboratory. Our results (Figure 2) show that turbulence exacerbates the detection imperfections, making the receiver more vulnerable to such attacks. As turbulence becomes stronger, the amount of information an eavesdropper could potentially obtain also increases. To reduce this security risk, we compare different types of light modes used to transmit quantum information. Our results demonstrate that structured light beams, specifically Laguerre-Gaussian modes, exhibit significantly greater resistance to turbulence compared to conventional Gaussian beams. In particular, higher-order Laguerre-Gaussian modes show the strongest resilience, with much smaller increases in information leakage under turbulent conditions. These results highlight the importance of choosing appropriate spatial light modes to improve the security of free-space QKD, helping to develop safer quantum communication systems for future long-distance applications.

**Source/Reference of the Work:** <https://doi.org/10.1002/qute.202500460>



**Figure 1:** Experimental setup used to implement the side-channel attack in the QST laboratory at PRL



**Figure 2:** Measured information leakage for different light modes as a function of turbulence strength.

## In Field Theory, the In-Out Way

### The Author



Namit Mahajan

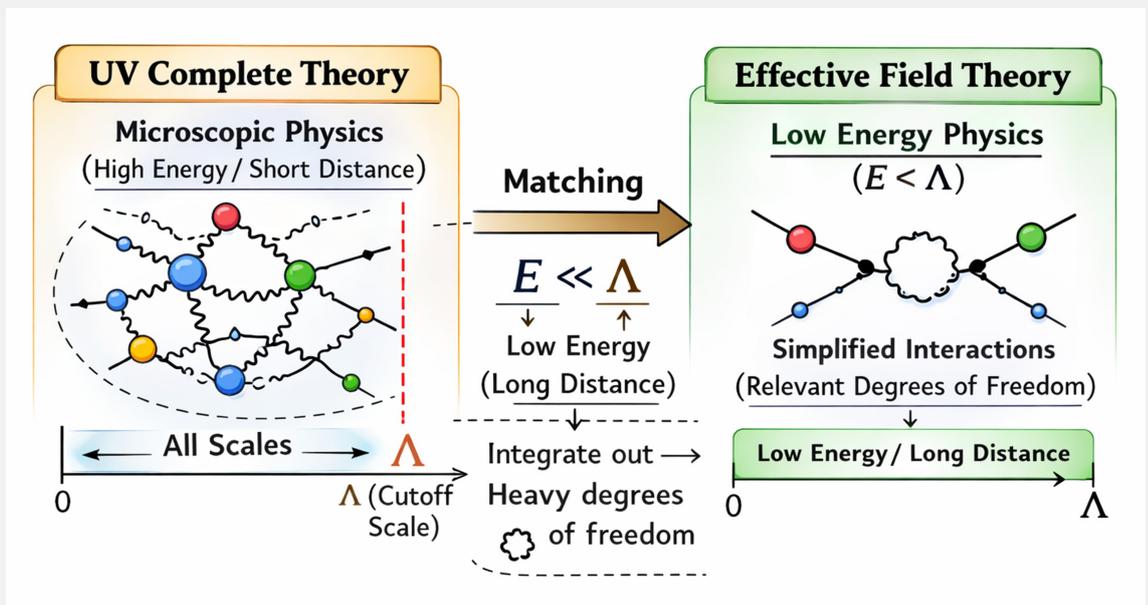
(Namit Mahajan)

The quantum description of collision or scattering processes and particle decays is formulated in terms of S-matrix elements using the In-Out formalism. In contrast, cosmological observables such as two-point functions and higher-order correlators are computed using the In-In formalism, which evaluates expectation values in a chosen early-time quantum state. At any given length, time, or energy scale, physics is described using the relevant dynamical variables, while the influence of shorter distances or higher energies is captured through effective coefficients multiplying allowed operators. This separation of scales is implemented through matching. Physical quantities, such as scattering amplitudes, are computed in both the complete theory, when known, and in an effective theory constrained by symmetries. Requiring agreement at an appropriate scale determines the effective couplings, or Wilson coefficients. When the complete theory is unknown, a consistently constructed effective theory is matched directly to experimental observations, making the framework powerful despite its apparent simplicity.

This systematic approach, known as effective field theory (EFT), is well developed within the In-Out formalism. However, comparatively little attention has been given to EFTs suitable for the In-In framework, which is essential for time-dependent and cosmological observables. In this work, an EFT appropriate for the In-In formalism is developed by closely following familiar In-Out methods, while carefully treating boundary terms that are usually neglected but play a central role in the In-In setting.

The construction is illustrated using a scalar field in flat spacetime and is naturally extended to cosmological backgrounds. It is further shown that the Schrödinger functional representation offers a clean and efficient framework for capturing these features and for computing general time-dependent amplitudes.

**Source/Reference of the Work:** [https://link.springer.com/article/10.1007/JHEP01\(2026\)030](https://link.springer.com/article/10.1007/JHEP01(2026)030)



**Figure Caption:** Pictorial overview of the concept

**The Author**

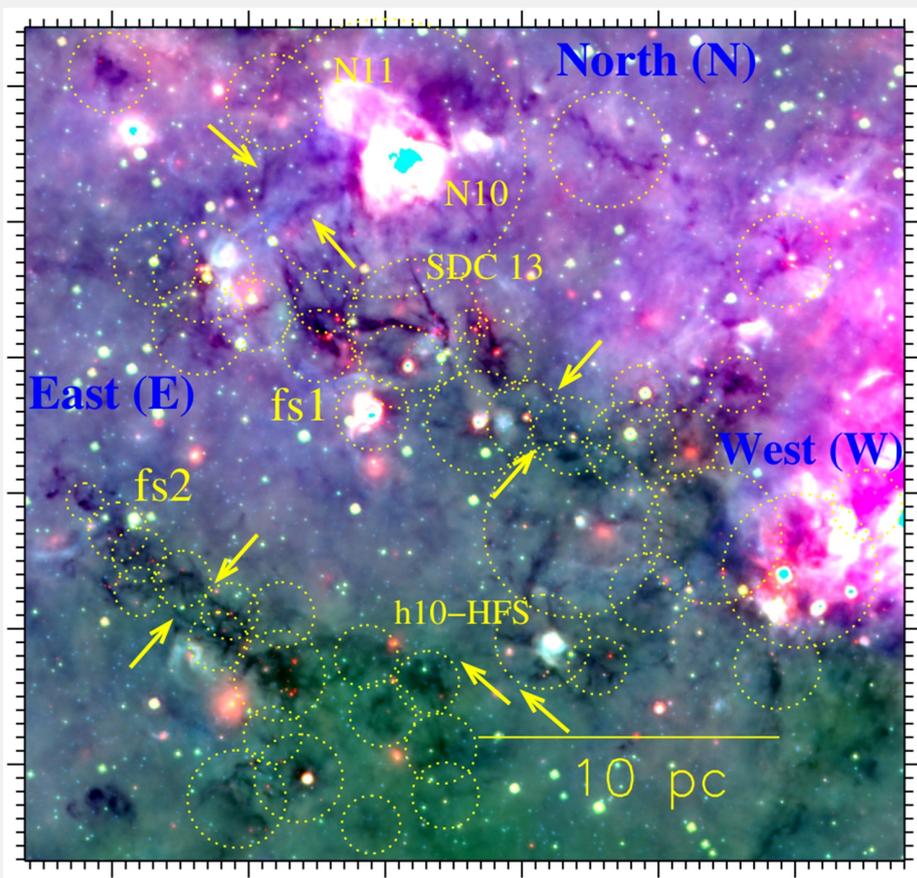
**Lokesh Kumar Dewangan**
**Discovery of a rich population of compact hub-filament systems in a single star-forming complex**

(Dewangan, Lokesh Kumar, Yadav, Ram K., Sharma, Saurabh, Jadhav, O. R., Maity, A. K., Goldsmith, Paul F. and Panchal, G.)

In recent years, hub-filament systems (HFSs) have emerged as key structures characterized by a network of filaments converging toward a central hub—typically the birthplace of massive OB stars ( $> 8 M_{\text{sun}}$ ) and young stellar clusters. Despite growing observational evidence, their typical number, spatial scale, formation mechanisms, and overall impact on star formation within a single cloud remain poorly constrained. To address these issues, a comprehensive multi-scale, multi-wavelength investigation of the filamentary structures in the W33 complex was conducted.

A rich population of 45 compact hub-filament systems, with a median size of  $\sim 2.4$  pc, is investigated toward dark filamentary structures in the W33 complex (see Figure). The hub-filament systems are preferentially located at the intersections of elongated infrared dark substructures and exhibit clear signatures of massive star formation and active protostellar clustering, while largely lacking radio continuum emission. To our knowledge, this is the first report of such a high concentration of small-scale hub-filament systems within a single star-forming complex. These results support a scenario in which cloud/filament fragments form compact hub-filament systems that promote efficient, clustered star formation, frequently leading to massive star formation.

**Source/Reference of the Work:** <https://doi.org/10.3847/1538-3881/ae25e7>



**Figure Caption:** Positions of selected compact hub-filament systems toward dark filamentary structures in the W33 complex.

## Uncovering universal behaviours at next-to-leading power

(Sourav Pal, **Satyajit Seth**)

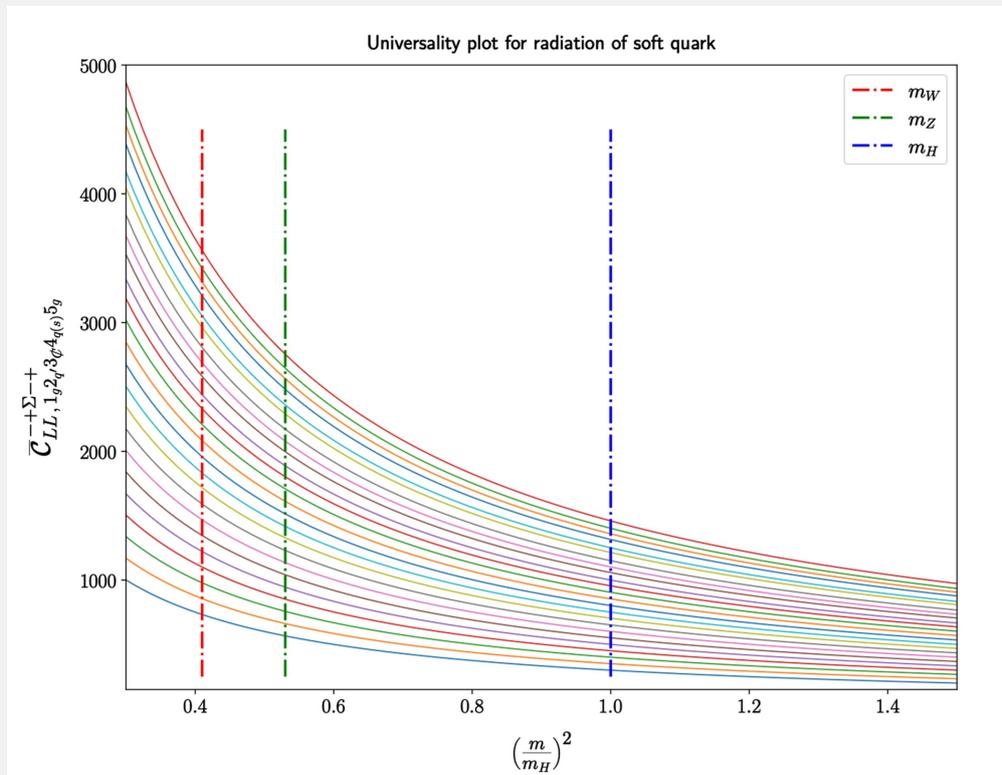
### The Author



Satyajit Seth

This research demonstrates that certain small but essential corrections in high energy particle collision computations are far more universal than previously believed. Specifically, when a massive colourless particle (such as a Higgs, W boson, or Z boson) is produced alongside a jet, the effects of low energy radiation yield sizable contributions that are crucial for precision measurements, but typically complicate theoretical estimations. These "next-to-leading power" corrections were conventionally thought to be dependent on the specific details of the process involved. However, we show that a large portion of these corrections actually follows a generic, simple pattern that applies across numerous different processes, irrespective of the nature of the massive colourless particle (see Figure). This finding streamlines theoretical calculations, improves the precision of predictions used at colliders like the Large Hadron Collider, and establishes a unified framework that essentially paves the way to more easily and accurately compare theoretical predictions with experimental results in the precision era.

**Source/Reference of the Work:** <https://doi.org/10.1103/wdqc-15rg>



**Figure Caption:** Once the key logarithmic features are known for Higgs+jet production (blue), the results for W+jet (red), and Z+jet (green) follow automatically, without additional calculation.

### Transport properties of stochastic fluids

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

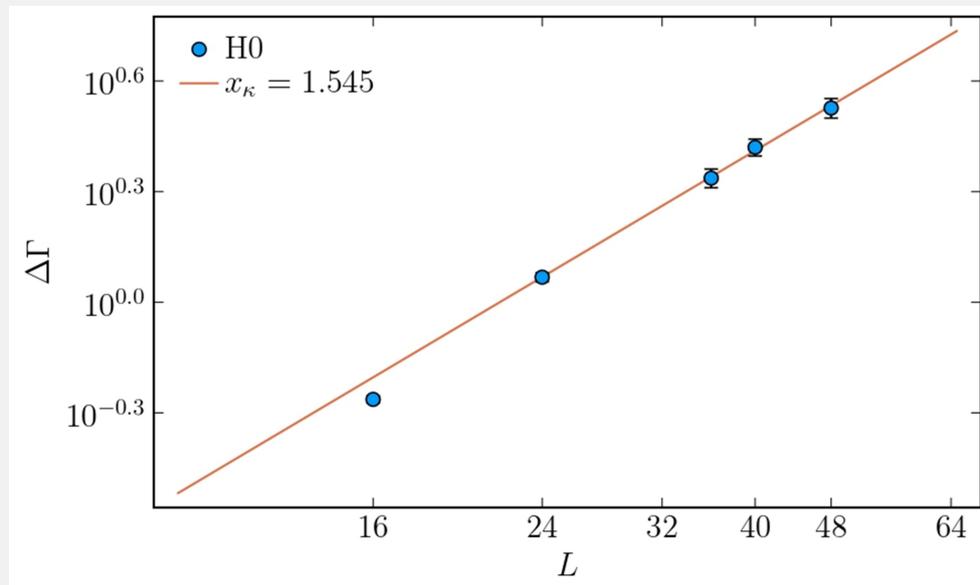
#### The Author



Chandroday  
Chattopadhyay

The phase diagram of Quantum Chromodynamics (QCD), the theory of strong interactions among quarks and gluons, exhibits a rich structure. It is conjectured that a line of first-order phase transition exists in the QCD phase diagram which terminates at a critical point. The QCD critical point is being actively searched for in heavy-ion collision experiments at the Relativistic Heavy-Ion Collider, where a hot and dense medium is created. Typically, this medium is well described by relativistic hydrodynamics. However, near a critical point, standard hydrodynamics break down due to enhancement of thermal fluctuations. In this work, we employed a stochastic hydrodynamic framework known as Model H, which couples the fluid's momentum density to an order parameter and captures key aspects of QCD critical dynamics. We studied the impact of thermal fluctuations on transport coefficients of the fluid, namely shear viscosity and thermal conductivity. These coefficients were extracted using Kubo relations from correlation functions of conserved currents. We found that near the critical point, both viscosity and thermal conductivity exhibit power-law divergences with system size, with thermal conductivity diverging more strongly (see Figure). These results demonstrate that critical fluctuations will significantly modify transport properties of a quark-gluon liquid passing close to a critical point.

**Source/Reference of the Work:** <https://doi.org/10.1103/kltq-qb4t>



**Figure Caption:** Divergence of thermal conductivity with system size in a critical three-dimensional fluid that is expected to describe the macroscopic dynamics near a QCD critical point.

## Atmospheric boundary layer characteristics during severe air pollution and fog events over Delhi: Insights from ground-based Lidar, satellites, and models

### The Author



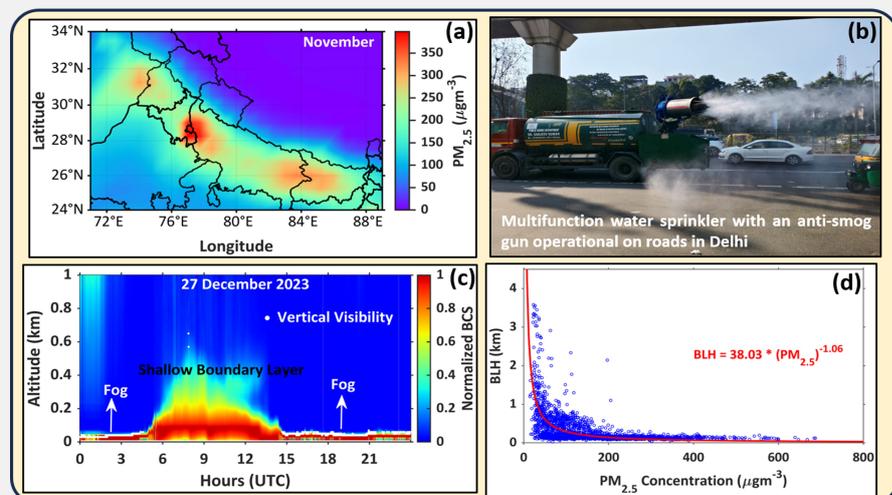
**Dharmendra Kumar Kamat**

(Dharmendra Kumar Kamat and Som Kumar Sharma)

Delhi experiences severe deterioration in air quality during the post-monsoon and winter seasons, driven by a combination of intense anthropogenic emissions and unfavorable meteorological conditions. The Atmospheric Boundary Layer (ABL), lowermost part of the Earth's atmosphere, acts as a confining volume for atmospheric pollutants, trace gases, and aerosols. This study examines the characteristics and dynamics of the ABL during episodes of extreme air pollution and fog over Delhi from October 2023 to February 2024, using ground-based Lidar observations, satellite data, and reanalysis products. Lidar measurements reveal a persistently shallow ABL (<1000 m) from November through January, with nocturnal boundary layer heights (BLH) strongly suppressed to ~200 m due to radiative inversions. During this period, elevated PM<sub>2.5</sub> concentrations exhibit a clear inverse power-law relationship with BLH (see Figure). The ventilation coefficient (VC) remained below 800 m<sup>2</sup> s<sup>-1</sup> from November to January, indicating highly unfavorable conditions for pollutant dispersion. Observations from INSAT-3D/3DR show a peak fog occurrence of approximately 75% over Delhi, with the highest frequency in January. The combined occurrence of haze, fog, and low-level clouds averaged ~22.46% during the study period, reaching maxima in November (~45.10%) and January (~39.55%). Ground-based Lidar observations captured fine-scale boundary layer processes, including shallow inversion layers, nocturnal ABL collapse, and detailed diurnal evolution, more effectively than reanalysis datasets. These findings provide valuable insights into boundary layer-pollution interactions and can contribute to improved urban weather modeling, enhanced air quality forecasting, and the development of more effective early warning systems in pollution-prone regions.

**Source/Reference of the Work:** <https://doi.org/10.1016/j.atmosenv.2025.121684>

**Figure Caption:** (a) Spatial distribution of mean PM<sub>2.5</sub> concentration over northern India during November 2023, highlighting enhanced pollution over the Indo-Gangetic Plain and the Delhi region. (b) Ground-level mitigation measures in Delhi showing the operation of a multifunctional water sprinkler system equipped with an anti-smog gun during severe pollution episodes. (c) Normalized Lidar backscatter over Delhi on 27 December 2023, illustrating dense fog occurrence, a persistently shallow atmospheric boundary layer (ABL), suppressed vertical visibility, and its diurnal evolution. (d) Scatter plot depicting the inverse power-law relationship between boundary layer height (BLH) and surface PM<sub>2.5</sub> concentration, emphasizing the strong coupling between shallow boundary layer conditions and elevated particulate pollution during the study period.



## SCOPOSIS 2025: Advancing Optics and Photonics Research

The Physical Research Laboratory (PRL), Ahmedabad, successfully hosted SCOPOSIS 2025 from December 8-12, 2025. This landmark international event unified two major scientific platforms for the first time: the 10th edition of the Student Conference on Optics and Photonics (SCOP) and the 48th Symposium of the Optical Society of India (OSI). Organized by the Atomic, Molecular, and Optical Physics Division and the PRL Optics Student Chapter, the event was held in PRL in collaboration with the Optical Society of India (OSI) and jointly hosted with the Space Applications Centre (SAC) and IIT Gandhinagar (IITGN).

The five-day program provided a comprehensive bridge between academic learning and advanced research. The event commenced with a two-day workshop featuring 16 tutorials for over 150 students. Sessions covered frontier topics including ultrafast optics, quantum science, and optical instrumentation for space applications. The main conference featured an inaugural talk on the single photon detector, 85 invited talks by experts of various fields, and over 300 contributory presentations across oral and poster sessions.

**Innovation and Industry:** A key highlight was the launch of two indigenous Quantum Science and Technology products, 'Samai' and 'Jonaki', developed at PRL, showcasing the institute's cutting-edge capabilities in quantum technology and its commitment to translating advanced research into impactful technological solutions.

The event drew a diverse audience of approximately 500 participants. This included 350 national delegates representing 125 institutions and 22 states across India, as well as 20 international experts from 13 countries, including the USA, Germany, Japan, Finland, and France. By providing a vibrant platform for PhD scholars and early-career researchers to interact with global researchers, SCOPOSIS 2025 fulfilled its mission to foster international collaboration and strengthen PRL's leadership in optics and quantum science. The event also facilitated industry-academia partnerships and enabled participants to explore PRL's advanced research laboratories.



Dignitaries at the inaugural ceremony of SCOPOSIS 2025, held at PRL



A glimpse of the international synergy at SCOPOPOS 2025, which brought together over 450 delegates from 13 countries.



The official launch of the indigenous Quantum Science and Technology product developed at PRL during SCOPOPOS 2025.

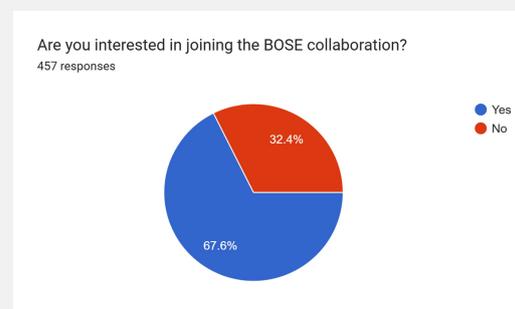
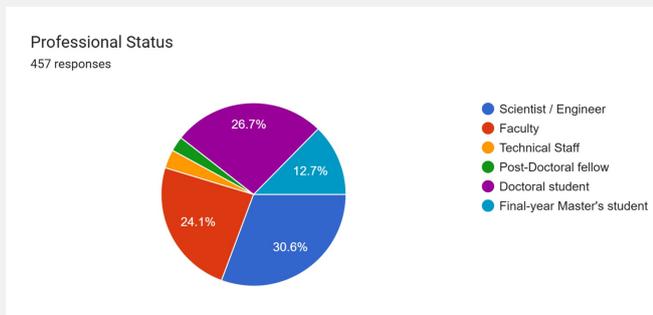
## One-Day Online Meeting on the Bhaskaracharya Observatory for the Search of Exoplanets (BOSE)

A One-Day Online Meeting on the Bhaskaracharya Observatory for the Search of Exoplanets (BOSE) was successfully held on 9 December 2025, organized by the Physical Research Laboratory (PRL). The meeting witnessed an enthusiastic response from the Indian astronomy community, with around 450 participants registered from institutes and universities across the country. Around 180 participants have actively present during the entire meeting time.

The meeting aimed to bring together observers, instrumentation experts, theorists, and students to discuss the scientific goals, technological challenges, and future prospects of the proposed BOSE mission, India's first space-based mission dedicated to the discovery and characterization of exoplanets.

The interactive sessions and discussions provided a valuable platform for community engagement, encouraging collaborative efforts and broad participation in the BOSE mission. The strong turnout and active involvement of participants reflected the growing interest and capability within the Indian exoplanet research community. The one-day programme covered BOSE detector and optics development, exoplanet architectures and atmospheres, synergies with Indian missions such as ExoWorlds, and follow-up capabilities using national and international facilities.

The meeting concluded with a panel discussion on science priorities, instrumentation, and collaborative pathways to maximize BOSE's scientific return. Overall, the meeting served as a crucial step toward establishing a cohesive scientific and technical community around BOSE and shaping its future development.



Glimpses from the event

## Raman Worskop

Physical Research Laboratory, jointly with TechnoS Instruments, organised a one-day Raman Workshop on December 16, 2025 to delve into advanced methodologies for molecular characterization and material analysis. Experience practical, hands-on training with state-of-the-art instrumentation under the guidance of leading industry professionals. Dr. Dwijesh Ray, PRL extended a warm welcome to the distinguished guests, delegates, and participants from ISRO centres, IITs, IIIT, PDEU, SPU, IPR, NFSU, GBU, Gandhinagar and the industrial partner, Gujarat Mineral Development Corporation. The inaugural session commenced with the ceremonial lighting of the lamp, followed by inaugural address by Prof. Anil Bhardwaj, Director, PRL. Dr. Avanish Srivastava, former Director, AMPRI, Bhopal delivered a talk about the Make in India Raman Spectrometer a CSIR New Millennium Indian Technology Leadership Initiative. Other distinguished guests include Dr. Sunil Parekh, Strategic Partner, Zydus Cadila Healthcare, Dr. Deepak K Sinha, CEO, GMRICS-GMDC and former Director, AMD and Dr. Tarun Sharda from TechnoS Instruments.

The lecture series featured a live demonstration of the IndiRam Raman Spectrometer, development for future Raman spectrometer payload activity at PRL, and the application of Raman in Meteoritics and Planetary Exploration. Additionally, hands-on training for portable, hand held and micro-Raman was organised for the post lunch session.

We hope to continue this successful initiative next year, focusing on broader application of Raman spectroscopy, more expert presentations, profound discussions, an increased number of paper presenters, and an expanded outreach within the scientific community on a larger scale.



Glimpses from the event

## 111th PRL ka Amrut Vyakhyaan



The 111th lecture of "PRL ka Amrut Vyakhyaan (PKAV)" was held on December 17, 2025, in online mode. The eminent speaker for the occasion was Prof. Minna Palmroth, Professor of Computational Space Physics at the University of Helsinki, Finland. The title of the Amrut Vyakhyaan was "Space is the new black".

Prof. Minna Palmroth is a professor in computational space physics at the University of Helsinki, jointly funded by the Finnish Meteorological Institute. Currently, she serves as the Director of two Finnish Centers of Excellence: Research of Sustainable Space (2018-2025) and Space Resilience (2026-2033).

In the Vyakhyaan, Prof. Minna Palmroth discussed how society's dependence on space increases and how vulnerabilities become more evident. She highlighted emerging risks that have recently materialised or may soon become problems in the booming space economy. Prof. Palmroth discussed about space is becoming a mundane part of our everyday life, and in fact, many companies may even forget that they are using space-borne technologies in their processes. Prof. Palmroth discussed the current state of space debris and the emerging challenges it poses. She elaborated on the Kessler syndrome, a theoretical scenario in which the density of objects in Earth's orbit becomes so high that collisions among them trigger a chain reaction, exponentially increasing the amount of debris. She emphasized the impacts of Earth's magnetic field dynamics on space weather and on Carrington-level events.

Following the lecture, an engaging Q&A session offered the audience fresh insights and additional details on the subject.

**YouTube Link:** [www.youtube.com/live/4A8dOTCUdIQ](https://www.youtube.com/live/4A8dOTCUdIQ)



## 31st PRL Amrut Rajbhasha Vyakhyaan



"पीआरएल अमृत राजभाषा व्याख्यान (पर्व)" का 31वां व्याख्यान 19 दिसंबर, 2025 को आयोजित किया गया था। इस अवसर पर मुख्य वक्ता डॉ. चंद्रमोहन नौटियाल थे, जो विज्ञानी एवं प्रमुख, रेडियोकार्बन प्रयोगशाला (सेवानिवृत्त), बीरबल साहनी पुराविज्ञान संस्थान, लखनऊ हैं।

The 31st lecture of "PRL Amrut Rajbhasha Vyakhyaan (PARV)" was held on December 19, 2025. The eminent speaker for the occasion was Dr. Chandramohan Nautiyal, Scientist and Head, Radiocarbon Laboratory (Retired), Birbal Sahni Institute of Palaeosciences, Lucknow.

डॉ. चंद्रमोहन नौटियाल का जन्म 01 अगस्त 1956 को मेरठ में हुआ। बी.एससी. (भौतिकी ऑनर्स) तक प्रारम्भिक शिक्षा के पश्चात उन्होंने रुड़की विश्वविद्यालय (वर्तमान आईआईटी-रुड़की) से भौतिकी में एम.एससी. की। 1985 से 2016 तक डॉ. नौटियाल ने बीरबल साहनी पुराविज्ञान संस्थान, लखनऊ में विज्ञानी तथा रेडियोकार्बन प्रयोगशाला के प्रमुख के रूप में कार्य किया और वहीं से अवकाश ग्रहण किया। उनके शोध कार्य जलवायु, पुरातत्व, उल्काविज्ञान एवं अंतर्विषयक विज्ञान पर केंद्रित रहे। उनके शोध पत्र EPSL, Astrophysical Journal, Meteoritics, GRL, Quaternary International, Current Science आदि प्रतिष्ठित पत्रिकाओं में प्रकाशित हुए।

Dr. Chandramohan Nautiyal was born on August 1, 1956, in Meerut. After completing his initial education up to B.Sc. (Physics Honors), he pursued his M.Sc. in Physics from the University of Roorkee (now IIT Roorkee). From 1985 to 2016, Dr. Nautiyal worked as a scientist and head of the radiocarbon laboratory at the Birbal Sahni Institute of Palaeosciences, Lucknow, from where he retired. His research focused on climate, archaeology, meteoritics, and interdisciplinary sciences. His research papers have been published in prestigious journals such as EPSL, Astrophysical Journal, Meteoritics, GRL, Quaternary International, and Current Science.

व्याख्यान का शीर्षक था/ The vyakhyaan was titled "भारत में हिन्दी में विज्ञान संचार का परिदृश्य"  
व्याख्यान में डॉ. नौटियाल ने चर्चा की कि, हिन्दी भाषियों की संख्या भारत में किसी भी अन्य भाषा को बोलने वालों की तुलना में अधिक है। स्वाधीनता के पूर्व भी अनेक विख्यात हिन्दी साहित्यकारों ने विज्ञान लेखन किया है। सरस्वती जैसी साहित्यिक पत्रिकाओं में विज्ञान पर लेख प्रकाशित हुए थे। अन्य भारतीय भाषाओं में भी स्तरीय विज्ञान लेखन हुआ है। स्वाधीनता के उपरान्त हिन्दी को राजभाषा बनाए जाने के साथ हिन्दी में विज्ञान प्रसार को और पंख लग गए। यह केवल विज्ञान, विज्ञान प्रगति, विज्ञान आपके लिए, इलेक्ट्रॉनिकी आपके लिए, वैज्ञानिक, वैज्ञानिक दृष्टिकोण जैसी पत्र-पत्रिकाओं तक ही सीमित नहीं रहा।

In the Vyakhyaan, Dr. Nautiyal discussed that the number of Hindi speakers in India is greater than that of speakers of any other language. Even before independence, many renowned Hindi writers contributed to science writing. Articles on science were published in literary magazines like Saraswati. High-quality science writing also existed in other Indian languages. After independence,

with Hindi being declared the official language, the dissemination of science in Hindi gained further momentum. This was not limited to magazines like Vigyan, Vigyan Pragati, Vigyan Aapke Liye, Electronics Aapke Liye, Vaigyanik, and Vaigyanik Drishtikon.

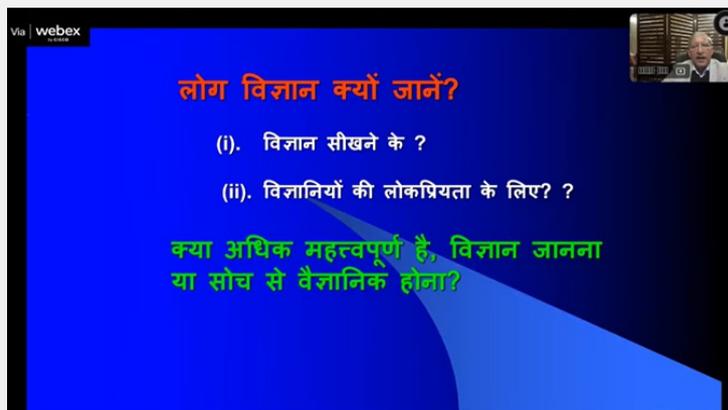
उन्होंने आगे कहा कि कई शोध संस्थान भी अब हिन्दी में पत्रिकाएं प्रकाशित कर रहे हैं। रेडियो, टेलीविजन और फिर आंकिकीकरण के साथ उदित नव मंचों पर आरंभिक हिचक के बाद हिन्दी में प्रचुर विज्ञान लेखन होने लगा है। हाल में ही चंद्रयानों के प्रक्षेपण तथा चंद्रयान -3 के अवतरण, मंगल यान एवं आदित्य L-1 के प्रक्षेपण तथा कक्षा में स्थापित होने एवं यात्रियों की अंतरिक्ष स्टेशन से वापिसी के समय दर्जनों चैनल हिन्दी में उन पर चर्चा कर रहे थे। उन्होंने उदाहरणों के साथ भारत में विज्ञान संचार में हिंदी द्वारा उठाए जा रहे बढ़ते कदमों पर भी चर्चा की।

He further added that many research institutions are now also publishing journals in Hindi. With the advent of radio, television, and then digital platforms, after initial hesitation, a wealth of science writing in Hindi has emerged. Recently, during the launches of the Chandrayaan missions and the landing of Chandrayaan-3, the launch and orbital insertion of Mangalyaan and Aditya L-1, and the return of astronauts from the space station, dozens of channels were discussing these events in Hindi. He also discussed with examples of the growing steps taken by Hindi in science communication in India.

व्याख्यान के बाद आयोजित एक रोचक प्रश्नोत्तर सत्र ने दर्शकों को विषय पर अतिरिक्त जानकारी और नए दृष्टिकोण प्रदान किए।

An interesting Q&A session that followed the lecture, provided the audience with further information and new perspectives on the topic.

**YouTube Link:** <https://youtube.com/live/5M0LB44sI6A?feature=share>



## Death Anniversary of Late Prof. Vikram A Sarabhai and Late Prof. K R Ramanathan

On the solemn occasion of 30th December, 2025, which marks the death anniversary of the esteemed founder of the Physical Research Laboratory, the Late Professor Vikram A. Sarabhai, and the following day, December 31, 2025, commemorating the death anniversary of the founding Director of PRL, the Late Professor K.R. Ramanathan, a heartfelt tribute was paid to these distinguished scientific pioneers. This tribute took place in the Foyer area of the K.R. Ramanathan Auditorium on Tuesday, the 31st December, 2025.

The portraits of Professor Vikram A. Sarabhai and Professor K.R. Ramanathan were adorned with garlands, and a lamp was lit in their memory, symbolizing the enduring impact of their contributions to science.

All members of PRL honored their legacy by offering floral tributes to these visionary leaders.



## PRL's Monthly Publication Digest

### Atomic, Molecular and Optical Physics [02]

1. Rachita Nandan, Tanya Sharma, R. P. Singh, Shashi Prabhakar, 2025, Impact of Atmospheric Turbulence on Spatial Mode Mismatch Attacks in Free-Space QKD Implementation, *Advanced Quantum Technologies*, Date of Publication: 30/12/2025, Impact Factor: 4.3
2. Monika Devi, Malika Singhal, Parth Khanduri, Naveen Chauhan and Ashok Kumar Singhvi, 2025, Application of a post-violet IR single-aliquot regenerative-dose (pVIR-SAR) protocol for natural polymineral fine and coarse-grain samples, *Quaternary Research*, Date of Publication: 23/12/2025, Impact Factor: 1.8

### Astronomy & Astrophysics Division [03]

1. A. S. Rajpurohit, V. Kumar, M. K. Srivastava, L. Labadie, K. Rajpurohit, and J. G. Fernández-Trincado, 2025, Exploring stellar activity in a sample of active M dwarfs, *Astronomy & Astrophysics*, Date of Publication: 13/12/2025, Impact Factor: 6.1
2. Sunil Chandra, Pankaj Kushwaha, Pranjupriya Goswami, and Michael Zacharias, 2025, Curious Case of CGRaBS J0211+1051: Observational Evidence of the Lepto-hadronic Origin of High-energy Emission?, *The Astrophysical Journal*, Date of Publication: 11/12/2025, Impact Factor: 5.4
3. Ahuja, G. and S. Ganesh, 2025, Dynamical Simulation of the Interstellar Comet 3I/ATLAS, *The Astrophysical Journal Letters*, Date of Publication: 04/12/2025, Impact Factor: 11.7

### Planetary Sciences Division [10]

1. Mukundan, V., Paul Withers, Smitha V. Thampi, Anil Bhardwaj, 2025, Decoupling the Influence of Solar Cycle and Seasons on Mars' Dayside Ionosphere: Insights from MAVEN Observations during the Declining Phase of Solar Cycle 24, *Icarus*, Date of Publication: 31/12/2025, Impact Factor: —
2. M. B. Dhanya, Chemukula Mathin Yadav, Smitha V Thampi, Tirtha Pratim Das, R Satheesh Thampi and Anil Bhardwaj, 2025, Impact of a Coronal Mass Ejection on the Lunar 2 Exosphere as observed by CHACE-2 on the Chandrayaan-2 Orbiter, *Geophysical Research Letters*, Date of Publication: 31/12/2025, Impact Factor: —
3. Thomas Maynadi'e, Yoshifumi Futaana, Stas Barabash, Martin Wieser, Shahab Fatemi, Audrey Vorburger, Anil Bhardwaj, Peter Wurz, Kazushi Asamura, 2025, Global Effects of Magnetic Anomalies on the Near-Surface Lunar Plasma Environment, *Journal of Geophysical Research: Space Physics*, Date of Publication: 31/12/2025, Impact Factor: —
4. Ray, D., Janaarathan, P.A., Bhui, U.K., Bulusu, V., Smith, A., Misra, S. and Sanjeev Kumar, 2025, The macromolecules and lipid biomarkers as seen in the Archaean White Mfolozi banded iron formation (BIF): Their biogenicity and implications for Mars, *Life Sciences in Space Research*, Date of Publication: 22/12/2025, Impact Factor: —
5. Satyandra M. Sharma, Varun Sheel, and Martin Pätzold, 2025, Identification and characterization of the topside bulge of the Venusian ionosphere, *ICARUS*, Date of Publication: 22/12/2025, Impact Factor: 3.508
6. James, S, Chandran, S.R., Janardhanan, A., Bhadrans, A., Drishya, G., Praveen, M.N., Chavan, A., Bhandari, S., Satyanaraynan, S., Ram Mohan, Ray, D., Sajinkumar, K. S., 2025, Enhanced understanding of the K-Pg boundary in the Indian subcontinent: Petrological, mineralogical, and geochemical insights. , *Meteoritics and Planetary Science*, Date of Publication: 19/12/2025, Impact Factor: —
7. Tanisha Ghosh, Reet Kamal Tiwari, Rishitosh K. Sinha, Rajiv R. Bharti, 2025, Late Amazonian Glaciation in the Acheron Fossae Region of Mars, *Advances in Space Research*, Date of Publication: 17/12/2025, Impact Factor: 2.8
8. Ray, D., H. Annadata, S. Sarkar, A.Ray. A. Das, S. Bhattacharya, A.D. Shukla and B. Ghosh, 2025, Mineralogy, VNIR (Visible Near-Infrared), and Fe XAS (X-ray Absorption) Spectroscopy of Terrestrial Hematite Analogs: Implications for Iron Speciation on Mars, *ACS Earth and Space Chemistry*, Date of Publication: 07/12/2025, Impact Factor: —

9. Ray, D., H. Annadata, S. Sarkar, A. Ray, A. Das, S. Bhaatacharya, A.D. Shukla and B. Ghosh, 2025, Mineralogy, VNIR (Visible Near-Infrared), and Fe XAS (X-ray Absorption) Spectroscopy of Terrestrial Hematite Analogs: Implications for Iron Speciation on Mars, ACS Earth and Space Chemistry, Date of Publication: 07/12/2025, Impact Factor: —
10. Yash Srivastava, James M. D. Day, Akira Yamaguchi, Amit Basu Sarbadhikari, 2025, Precious metal enrichment during impacts on the Moon, Communications Earth & Environment, Date of Publication: 06/12/2025, Impact Factor: 8.9

#### **Space and Atmospheric Sciences Division [05]**

1. A. Chaurasia, and A. Guharay, 2025, Signature of intraseasonal oscillations during Hunga Tonga volcanic eruption, Advances in Space Research, Date of Publication: 24/12/2025, Impact Factor: 2.8
2. Dharmendra Kumar Kamat, Som Kumar Sharma, Prashant Kumar, Kondapalli Niranjan Kumar, Sourita Saha, Aniket, 2025, Investigation of cloud characteristics over a high-altitude region, Mt. Abu, using ground-based Lidar and satellite observations, Theoretical and Applied Climatology, Date of Publication: 23/12/2025, Impact Factor: 2.7
3. Kamran Ansari, S. Ramachandran and R. Cherian, 2025, Global assessment of aerosol radiative effects: New insights from observations, reanalysis, and climate models , Science of the Total Environment, Date of Publication: 18/12/2025, Impact Factor: 8.0
4. Aakash Gupta, Dibyendu Chakrabarty, Santosh Vadawale, Aveek Sarkar, Bijoy Dalal, Shiv Kumar Goyal, Jacob Sebastian, P. Janardhan, Nandita Srivastava, M. Shanmugam, Neeraj Kumar Tiwari, Aaditya Sarada, Piyush Sharma, Anil Bhardwaj, Prashant Kumar, Manan S. Shah, Bhas Bapat, Pranav R. Adhyaru, Arpit R. Patel, Hitesh Kumar Adalja, Abhishek Kumar, Tinkal Ladiya, Sushil Kumar, Nishant Singh, Deepak Kumar Painkra, Abhishek J. Verma, Swaroop Banerjee, K. P. Subramanian, and M. B. Dadhania., 2025, Multidirectional Investigations on Quiet Time Suprathermal Ions Measured by ASPeX-STEPS on Board Aditya L1, The Astrophysical Journal, Date of Publication: 08/12/2025, Impact Factor: 5.4
5. Dharmendra Kumar Kamat, Som Kumar Sharma, Prashant Kumar, Kondapalli Niranjan Kumar, Sourita Saha, Aniket, Sukhwinder Kaur, Arun, 2025, Atmospheric boundary layer characteristics during severe air pollution and fog events over Delhi: Insights from ground-based Lidar, satellites, and models, Atmospheric Environment, Date of Publication: 03/12/2025, Impact Factor: 3.7

#### **Geosciences Division [01]**

1. Chinni, Venkatesh; Singh, Naman Deep; Singh, Sunil Kumar and Goswami, Vineet, 2025, Biogeochemical cycling of dissolved zinc in the Indian Ocean, Limnology and Oceanography, Date of Publication: 10/12/2025, Impact Factor: 3.7

#### **Udaipur Solar Observatory [01]**

1. Anshu Kumari, Nat Gopalswamy, 2025, A type II solar radio burst without a coronal mass ejection association, J. Astrophys. Astr. , Date of Publication: 12/12/2025, Impact Factor: 1.6

#### **Theoretical Physics [01]**

1. Chandrodoy Chattopadhyay, Josh Ott, Thomas Schaefer, Vladimir V. Skokov, 2025, Transport properties of stochastic fluids, Physical Review D, Date of Publication: 15/12/2025, Impact Factor: 5.3

## Visitors

1. Prof. Hamasaki Koji, Atmosphere and Ocean Research Institute, University of Tokyo, Japan visited Physical Research Laboratory, Ahmedabad on 08.12.2025 for scientific discussion with PRL Scientists and interaction with Research Scholars.
2. Thirty eight (38) students and Three (3) teachers from Wisdom Academy Senior Secondary school, Biloda, Chittorgarh have visited Udaipur Solar Observatory (USO), PRL, Udaipur on 11.12.2025 to see various scientific facilities at USO.
3. Mr. Amartya Pal, Senior Research Fellow, Institute of Physics, Bhubaneswar visited Physical Research Laboratory, Ahmedabad from 16.12.2025 to 20.12.2025 to give a seminar.
4. Mr. Srikanth Kodeboyina from Blue Eye Soft Corporation, USA visited Physical Research Laboratory, Ahmedabad on 23.12.2025 for scientific discussion and to explore possible collaborative opportunities/tech transfer/build capacity.
5. Prof. Vishal Verma, University of Illinois, USA visited Physical Research Laboratory, Ahmedabad on 23.12.2025 for scientific discussion with PRL Scientists and interaction with Research Scholars.
6. Six Defense Personnel have visited Udaipur Solar Observatory (USO), Udaipur on 26.12.2025 to see various scientific facilities at USO.
7. During December 2025 two officials from other DOS/ISRO centres/units, an Inspector General of CRPF Mt. Abu, eleven defense personnel, and forty five other people have visited Infra-Red Observatory (IRO), PRL, Mount Abu to see various facilities at IRO.

## Awards & Honors

Ms. Chandrima Shaw, Postdoctoral Fellow, Geosciences Division, won third prize for her oral presentation at the 14th Asian Aerosol Conference (AAC) 2025, held in Mumbai from 1-4 December 2025

**OBITUARY**



स्वर्गीय श्री बी.बी. राजपूत  
Late Shri B.B. Rajput  
Tradesman-F

**Date of Birth** 25.09.1948

**Date of Joining PRL** 01.06.1970

**Date of Retirement** 30.09.2008

**Date of Death** 15.12.2025

Teary Eyes for our Departed Member

## Hearty welcome to our new members



**NAME:** MR. AMRIT SHANKAR MISHRA

**DESIGNATION:** SCIENTIST/ENGINEER-SC

**DATE OF JOINING:** 24.11.2025

**DIVISION/AREA:** SPACE & ATMOSPHERIC SCIENCES DIVISION



**NAME:** MR. ATHUL P. RAJ

**DESIGNATION:** ASSISTANT

**DATE OF JOINING:** 04.12.2025

**DIVISION/AREA:** PURCHASE SECTION



**NAME:** DR. ANKESH TIWARI

**DESIGNATION:** POST DOCTORAL FELLOW-SERB-NPDF

**DATE OF JOINING:** 04.12.2025

**DIVISION/AREA:** SPACE & ATMOSPHERIC SCIENCES DIVISION



**NAME:** MR. CHIRAG

**DESIGNATION:** JR. PERSONAL ASSISTANT

**DATE OF JOINING:** 05.12.2025

**DIVISION/AREA:** SPACE & ATMOSPHERIC SCIENCES DIVISION



**NAME:** DR. SHILPA SRIMANI

**DESIGNATION:** POST DOCTORAL FELLOW-SERB-NPDF

**DATE OF JOINING:** 15.12.2025

**DIVISION/AREA:** GEOSCIENCES DIVISION



**NAME:** MR. SHRUTITIRTHA BHATTACHARJEE

**DESIGNATION:** JUNIOR RESEARCH FELLOW

**DATE OF JOINING:** 15.12.2025

**DIVISION/AREA:** PLANETARY SCIENCES DIVISION



**NAME:** MR. ABHISHEK KUMAR SINGH

**DESIGNATION:** JUNIOR RESEARCH FELLOW

**DATE OF JOINING:** 15.12.2025

**DIVISION/AREA:** PLANETARY SCIENCES DIVISION



**NAME:** MR. JITENDRA KUMAR NAIK

**DESIGNATION:** JUNIOR RESEARCH FELLOW

**DATE OF JOINING:** 15.12.2025

**DIVISION/AREA:** SPACE & ATMOSPHERIC SCIENCES DIVISION



**NAME:** MR. AYUSH KUMAR SAHU

**DESIGNATION:** JUNIOR RESEARCH FELLOW

**DATE OF JOINING:** 15.12.2025

**DIVISION/AREA:** PLANETARY SCIENCES DIVISION



**NAME:** MS. BHAVANA KHATRI

**DESIGNATION:** JUNIOR RESEARCH FELLOW

**DATE OF JOINING:** 17.12.2025

**DIVISION/AREA:** PLANETARY SCIENCES DIVISION



**NAME:** DR. SOUMYA ROY

**DESIGNATION:** POST DOCTORAL FELLOW-ANRF-NPDF

**DATE OF JOINING:** 29.12.2025

**DIVISION/AREA:** ASTRONOMY & ASTROPHYSICS DIVISION

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