

*Newsletter of the Physical Research Laboratory*

# THE SPECTRUM



**Participants of Frontiers in Geosciences  
Research Conference at PRL**

*March 2025*

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## Global insights on absorption characteristics of aerosols

### The Author

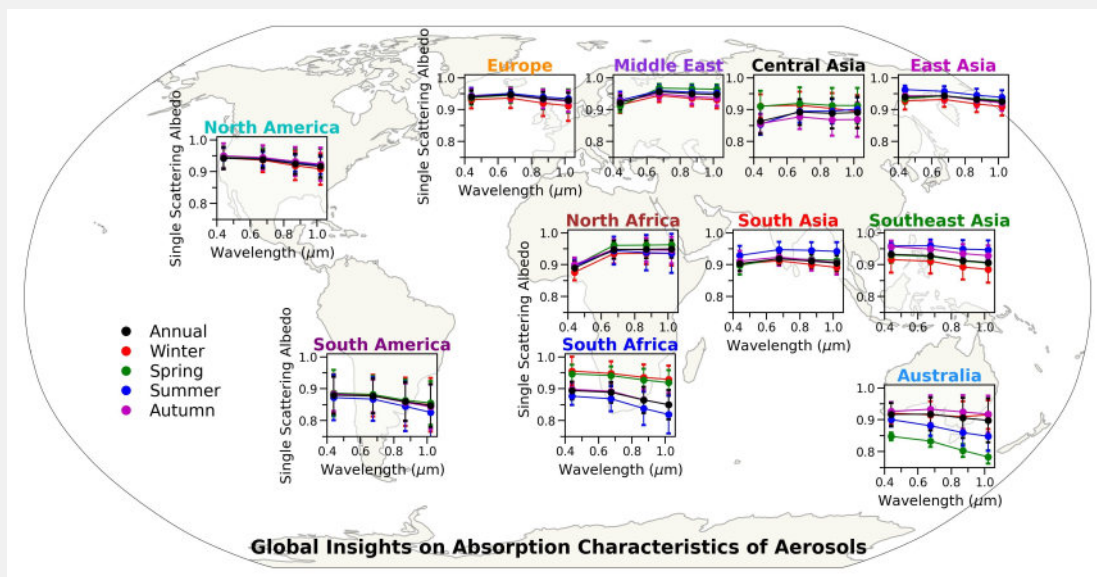


**Kamran Ansari**

(Kamran Ansari, S. Ramachandran)

Aerosols significantly impact the Earth-atmosphere radiation budget by scattering and absorbing the incoming solar radiation, referred to as aerosol radiative forcing (ARF). A key challenge in estimating ARF arises due to uncertainty in aerosol absorption parameters (single scattering albedo (SSA) and absorption aerosol optical depth (AAOD)) and scarcity in their accurate measurements. SSA is a critical parameter for determining both the magnitude and sign of ARF. A comprehensive analysis of aerosol absorption parameters using high-quality AEROSOL ROBOTIC NETWORK (AERONET) observations, and collocated validation of Modern-Era Retrospective Analysis for Research and Applications-2 (MERRA-2) simulations over the globe, is conducted on a seasonal scale, for the first time. AERONET SSA is lower in Central Asia (0.86) and South Asia (0.90) than in East Asia (0.93) and Southeast Asia (0.94). AAODs over Southeast and East Asia are ~50% lower than in South Asia (~0.07). Globally, the highest AAOD ( $>0.1$ ) is observed over central Africa during winter due to intense biomass burning and dust aerosols. North America, Europe, and Middle East exhibit minimal seasonal variations in aerosol absorption, indicating less seasonal variations in regional aerosol composition and size distribution. Bias in MERRA-2 SSA is lower with high Global Climate Observing System (GCOS) fraction ( $>50\%$ ) for moderately absorbing aerosols ( $0.90 \leq \text{SSA} < 0.95$ ) compared to less absorbing ( $\text{SSA} \geq 0.95$ ) and more absorbing ( $\text{SSA} < 0.90$ ) aerosols (GCOS fraction:  $<50\%$ ). Our findings provide critical global insights on aerosol absorption characteristics and their variability for improving model simulations as well as satellite retrievals on seasonal and global scales, and are useful to reduce uncertainties in assessing radiative and climate impact of aerosols.

Source/Reference of the Work: <https://doi.org/10.1016/j.scitotenv.2024.178178>



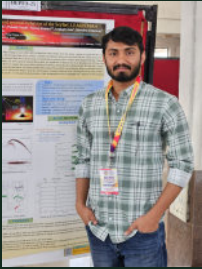
**Figure Caption :** Variation of aerosol single scattering albedo (SSA) in the wavelength range of 0.44–1.02  $\mu\text{m}$  across the globe.



## A Long-term Study of Mrk 50: Appearance and Disappearance of Soft Excess

### The Author

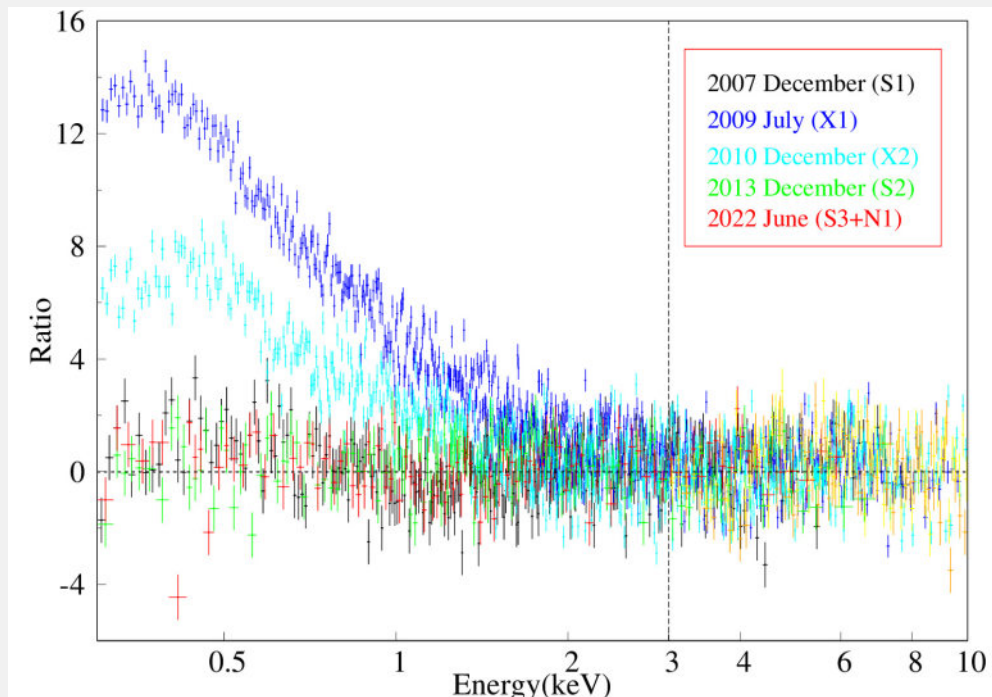
(**Narendranath Layek**, Prantik Nandi, Sachindra Naik and Arghajit Jana)



**Narendranath Layek**

Active galactic nuclei (AGNs) are the most luminous and energetic sources in the universe, powered by the accretion of matter onto supermassive black holes (SMBHs) located at the centers of host galaxies. X-ray emission from AGN is a crucial tool for studying extreme gravity, as it originates from inverse Compton scattering of ultraviolet (UV) photons from the accretion disk by a hot electron cloud ( $T \sim 10^7$ - $10^9$  K). The soft excess refers to an enhancement of flux in the soft X-ray range (below  $\sim 2$  keV) over the primary power-law continuum, commonly observed in most Seyfert 1 AGNs. Its origin is a long-standing and unsolved puzzle in AGN studies. To investigate this, we conducted an extensive temporal and spectral analysis of the Seyfert 1 AGN Mrk 50, utilizing 15 yr (2007-2022) of UV to X-ray observations from XMM, Swift, and NuSTAR for the first time. Two possible physical scenarios explain the origin of soft excess in AGNs (1) Warm Comptonization, where disk photons are scattered by a warm corona, and (2) Reflection from the ionized accretion disk. Our spectral analysis revealed no absorption in the low-energy domain throughout the 15 years of observation, suggesting no intrinsic obscuration around the central engine, confirming the nucleus as a 'bare' type. During the observations from 2007 to 2010, we detected a prominent soft excess, however, this component disappeared in later observations (shown in Figure). Both physical models successfully explained this behaviour. Further, we investigated the origin using a model-independent approach using cross-correlation analysis between two X-ray bands (soft and hard) to examine the correlations and delays between them. However, we did not find any correlation and time lag between them indicating that both Comptonization and reflection contribute to the origin of soft excess in Mrk~50.

Source/Reference of the Work: <https://doi.org/10.3847/1538-4357/adab>



**Figure Caption:** The ratio plots of five spectra from five epochs of observations, obtained by extrapolating the primary power-law continuum to lower energies. An enhancement of flux below 2 keV is clearly visible in the spectra from the 2007 (S1), 2009 (X1), and 2010 (X2) observations. However, no soft excess is detected in the spectra from the 2013 (S2) and 2022 (S3+NU) observations

## The Author



**Debashis Pachhar**

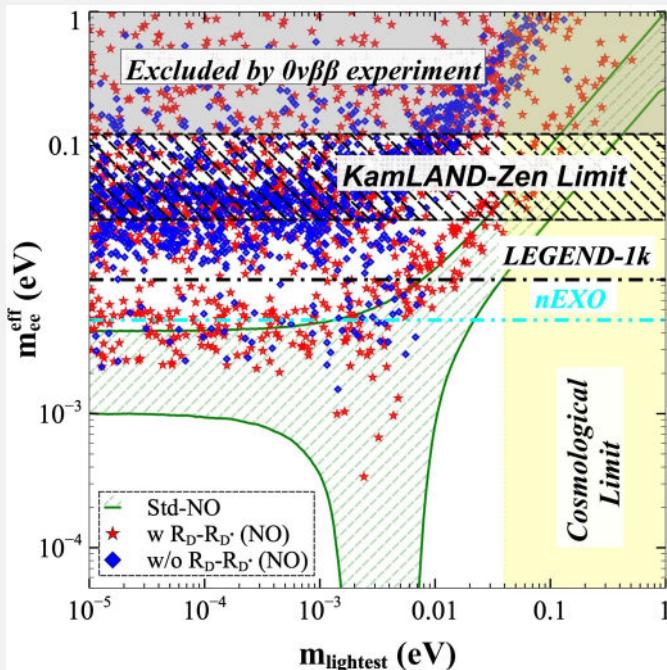
## Neutrino mass, Neutrinoless double beta decay and flavour observables via scalar leptoquarks

(PS Bhupal Dev, Srubabati Goswami, Chayan Majumder and **Debashis Pachhar**)

The process of double beta decay in which no neutrinos are emitted can provide a smoking gun signal for violation of lepton number – a quantum number associated with the leptons, a class of fundamental particles. Such violations are often linked to generation of masses for neutrinos.

PRL scientists with collaborators from the US and UK performed a comprehensive analysis of neutrinoless double beta decay process and its interplay with low-energy flavor observables in a radiative neutrino mass model with scalar leptoquarks. Leptoquarks are particles that can couple to both leptons and quarks and hence can contribute to the neutrino less double beta decay. The implications of these leptoquarks for the neutrino mass and neutrino less double beta decay were discussed for parameter values consistent with different experimental observations. It was found that in the presence of leptoquarks the lifetime (generally expressed as  $m_{\beta\beta}^{\text{eff}}$ , which is inversely proportional to the life time) of the neutrinoless double beta decay process can be different than the standard case. This can be probed in future ton scale neutrinoless double beta decay experiments.

Source/Reference of the Work: [https://doi.org/10.1007/JHEP01\(2025\)004](https://doi.org/10.1007/JHEP01(2025)004)



**Figure Caption:** Plot of  $m_{\beta\beta}^{\text{eff}}$  as a function of the lightest neutrino mass for normal ordering of active neutrino masses. Blue and red points denotes that scalar leptoquarks modifies the standard  $m_{\beta\beta}^{\text{eff}}$  which is denoted as the green hatched region.



## Frontiers in Geosciences Research Conference (FGRC) 2025 at PRL

Physical Research Laboratory (PRL), Ahmedabad, successfully hosted the Frontiers in Geosciences Research Conference (FGRC) 2025 during February 5-7, 2025, bringing together leading scientists, early-career researchers, and students to discuss cutting-edge advancements and future directions in geosciences research in India. The conference served as a vibrant platform for knowledge exchange, fostering collaborations and pushing the frontiers of scientific inquiry. FGRC 2025 witnessed the participation of approximately 250 researchers from 76 institutes and universities across India, ranging from young master's and Ph.D. students to distinguished senior scientists.

The conference featured engaging keynote lectures, invited talks, and contributed presentations, covering a wide spectrum of geoscience disciplines, including solid earth studies, climate change, marine and terrestrial biogeochemistry, aerosol chemistry, hydrological sciences, oceanography, earth surface processes, and modern modeling and analytical techniques. The Secretary, Department of Space and Chairman, ISRO extended his message and best wishes for the success of the event, while PRL's Council Chair delivered an inaugural address online, commending the initiative and suggesting further improvements. The conference was formally inaugurated by Prof. Anil Bhardwaj, who emphasized PRL's contributions to national and global geoscience research and highlighted the growing significance of interdisciplinary approaches. Renowned climate scientist Prof. B. N. Goswami delivered the keynote address, offering insightful perspectives on the present and future changes in the Indian monsoon system, their potential consequences, and the necessary actions for scientists and policymakers.

The technical sessions covered emerging research themes, with presentations from both senior and early-career researchers. The event also provided a valuable platform for young researchers to showcase their work, with the best papers receiving awards. FGRC 2025 at PRL was a resounding success, reaffirming the institute's commitment to scientific excellence and interdisciplinary geoscience research. Future FGRC events will continue to expand the horizons of geoscientific exploration and innovation, further strengthening India's position in global geoscience research.



Prof. B N Goswami delivering his key note address



Participants showcasing their research through posters



Delegates of FGRC 2025

## PRL Annual Bridge Tournament 2024-25

The PRL Annual Bridge Tournament for 2024-25 was successfully held on February 10, 2025, at the prestigious Ellisbridge Gymkhana.

Under the expert supervision of Tournament Director Mr. S. K. Shah, the tournament ran smoothly, ensuring a fair and engaging experience for all participants. The players showcased remarkable strategy and skill, making each match an exhilarating challenge.

### ***Tournament Highlights & Results***

The tournament featured an exceptional level of play, with the top three pairs emerging victorious after a series of challenging rounds. The dedication of the players and their strategic prowess were truly commendable.

Position	Players	Match Tops/Points	Score %
First	Alok Shrivastava & Tejas Sarvaiya	130/240	54.17%
Second	Dinesh Mehta & Soma Koted	112/240	46.67%
Third	Pradeep Sharma & Rajesh Kaila	101/240	42.08%



## Special lecture on VAST (SAFE and VISWAS)

A special lecture on VAST (SAFE and VISWAS) was organized at Physical Research Laboratory (PRL) on February 11, 2025, to enhance awareness among staff members about this exclusive scheme for ISRO/DOS employees. The session was conducted in a hybrid mode, witnessed enthusiastic participation, with around 150 attendees from all four PRL campuses.

The lecture was delivered by Shri Piyush J. Bhanani, Trustee, VAST, from Space Applications Centre (SAC), Ahmedabad. He provided valuable insights into the unique benefits of the scheme, explaining its provisions in detail and addressing queries from the participants. The session served as an excellent platform for employees to gain a deeper understanding of SAFE and VISWAS, ensuring they could make the most of the opportunities offered by VAST.



Glimpses of the event



## CNIT Division Nukkad – “Chai Pe Byte”

The 1st CNIT Division Nukkad – “Chai Pe Byte” of the year 2025 on “Automation: Transforming Web Content Management” was held on February 12, 2025 in offline mode from 10:00hrs to 11:00hrs. There were total 41 participants who attended the session. In the session, 80% discussion was in Hindi and 20% discussion was in the English.

The primary objective of the “Chai Pe Byte” initiative is to facilitate knowledge sharing and experience exchange, identify and address IT related concerns of users, and explore potential solutions. This initiative aims to foster a stronger bond between the CNIT division and PRL colleagues, ultimately enhancing the overall effectiveness and efficiency of PRL’s IT services and facilities.

Mr. Jigar Raval warmly welcomed all the participants in the 1st session of CNIT Division Nukkad – Chai Pe Byte on “Automation: Transforming Web Content Management” and briefed the objective of the session. The main objective of the session were:

1. Informing users about the integration of automation within the web content management system of the PRL website.
2. Providing guidance on how to manage the content using the online facility.
3. Outlining the roles and responsibilities of the respective Division's/Section's web content managers.

Mr. Prashant Jangid provided an overview of the framework designed to automate web content for rapid information dissemination on the PRL website. He highlighted how this automation would facilitate technology migration and ensure compliance as per the Guidelines for Government of India Website (GIGW) 3.0. He also briefed participants on the new GIGW 3.0, and outlined the roles and responsibilities of web content custodians in terms of moderation, approval and updation process. He demonstrated online web content management through portal.

Following are the overall outcome of the session:

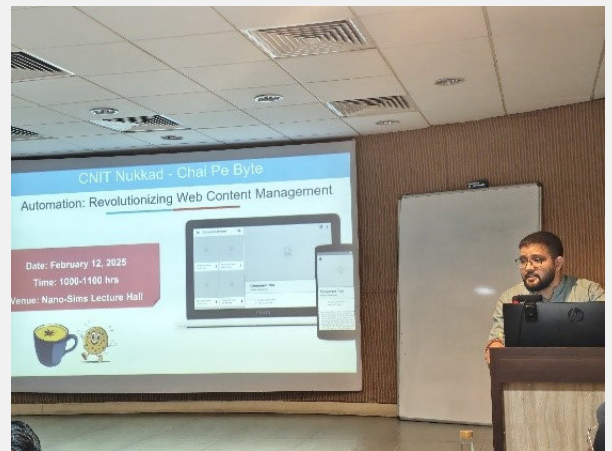
1. Explore to automate publication details in the required format of Annual Report.
2. Share the document of respective user’s roles and responsibilities for web content management.
3. Gradually, the Publication page of all the scientific divisions will be changed to new approved format. To get the old publication details from the divisions to populate in database, share format in the xls file to the respective Division’s Web Content Manager.
4. Information updation by respective PRL fraternity regarding “Publications”, “Books” and “Proceedings” should be in Annual Report format.
5. Explore the possibilities to automate web content update information to citizens using RSS feed feature.

All the participants have appreciated the collective contribution of all the PRL colleagues to make the PRL website updated with latest information. In particular, the participants appreciated the sincere efforts of (a) all the Division’s / Section’s Web Content Manager (b) Ms. Rumkee Dutta & Mr. Sourabh Goyal for maintaining website content in Hindi (c) Dr. Bhushit Vaishnav for timely publishing information on the PRL’s Social Media Accounts and (d) Web Admin team (Mr. Prashant, Mr. Dinesh, Mr. Atul, Mr. Girish, Mr. Rahul and Ms. Srishti) for developing software for automation in PRL web

content management.

All the participants actively participated in the event and appreciated the efforts of the CNIT division. All the participants have jointly prepared the report.

The detailed report of the session is available on CNIT Division Website, accessible within PRL LAN. URL: <https://www.prl.res.in/prl-eng/cc/intranet/chaipebyte>.



Glimpses of the event

## Swachhta Pakhwada 2025 at PRL, Ahmedabad

In line with the directives from the Department of Space (DOS) and the Government of India's initiative, the Physical Research Laboratory (PRL) observed Swachhta Pakhwada from February 1 to February 20, 2025. Although the official duration of Swachhta Pakhwada is from February 1 to February 15, PRL extended the event to 15 working days to ensure effective execution. This initiative was carried out following the communication received from CEPO/CPG/Gen-85/SAP dated December 10, 2024, regarding the Swachhta Pakhwada 2025 Action Plan. The campaign focused on several key areas, including improvements to departmental canteens and residential colonies, Shramdaan activities in nearby communities, Swachhta audits, and promoting a competitive spirit towards cleanliness.

As part of the initiative, PRL organized various activities to raise awareness about the importance of cleanliness. These activities included:

- Swachhta Pledge, Signature Campaign and Selfie Point: Encouraging PRL members to commit to maintaining cleanliness.
- Swachhta Drive: A comprehensive cleaning campaign within the PRL premises.
- Competitions: Engaging activities such as essay writing, waste-to-wealth, and video clip-making competitions to instill the values of cleanliness.
- Canteen Renovation: In line with the initiative, PRL renovated the wash area of the canteen at the Main Campus and the Dining Hall at the Students' Hostel to ensure a cleaner and more hygienic environment. The renovation of the PRL Main Campus Canteen was initiated during the Swachhta Pakhwada.
- School Outreach Program: Awareness campaigns conducted by the Ahmedabad Campus and Mount Abu Observatory in schools to educate children on the importance of cleanliness.
- Health Checkup camp A health camp was conducted for the contractual members of Housekeeping, Gardening, and Contract Labours by the PRL Dispensary at the Ahmedabad Campus.
- Waste to Wealth Initiative: An innovative activity where participants crafted eco-friendly pots using a pottery wheel by blending waste paper with soil, reinforcing the principles of sustainability and resourcefulness.
- Sanitation and Maintenance Activities: As part of Swachhta Pakhwada, comprehensive cleanliness and hygiene measures were undertaken, including fogging, fumigation, pest control, pond cleaning, solar panel maintenance, water tank cleaning, and efficient waste disposal to ensure a cleaner and healthier environment.
- PRL has been notified as a NO PLASTIC ZONE with an appeal to all PRL members to eradicate single-use plastic.

The concluding function of Swachhta Pakhwada took place on February 20, 2025. During the event, Professor Anil Bhardwaj, Director of PRL, emphasized the importance of cleanliness and environmental sustainability. Sh. Sanjay Wairagade, Chair of Swachhata Pakhwada Committee 2025 (SwPC 25), provided an overview of the activities carried out during the campaign. Sh. Pradeep Kumar Sharma, Convener of SwPC, administered a mass pledge that reinforced the



collective commitment to cleanliness. The event also included a prize distribution ceremony to honor the winners of various competitions.

A key highlight of the event was the 21st PARV Vyakhyaan, delivered by Dr. Tejas Doshi, a renowned family physician, Swachh Bharat Abhiyan (Gujarat) Brand Ambassador, and motivational speaker. His thought-provoking talk, titled "Environmental Protection, Cleanliness, and Plastic Liberation: An Essential Duty of Democracy," resonated deeply with the audience and inspired them to take active steps toward creating a cleaner and more sustainable environment.

The housekeeping, gardening, and canteen staff at PRL play a crucial role in maintaining the cleanliness and beauty of the PRL campuses. To honor their invaluable contributions, they were invited as special attendees. Their dedication and efforts are recognized as the foundation of PRL's commitment to cleanliness (Swachhta).

The successful implementation of Swachhta Pakhwada 2025 at PRL emphasized the significance of cleanliness within the institution and promoted awareness and community involvement, in line with the broader goals of the Swachh Bharat Abhiyan.



Glimpses of the event

## **Swachhta Pakhwada – 2025 organized at Udaipur Solar Observatory / PRL, Udaipur**

Realizing the spirit of Swachhata Hi Seva Hai, Udaipur Solar Observatory / PRL, Udaipur organized Swachhata Pakhwada 2025 from February 1 to February 15 with great enthusiasm and active participation. The main objective of this campaign was to inculcate the importance of cleanliness, promote environmental protection and ensure a clean and healthy workplace.

All the Staff Members, Research Scholars, PDFs and Trainees joined this initiative with full dedication, due to which this event did not remain just a formality but emerged as an inspiring example.

1. **Swachhata Shapath – Pledge for cleanliness:** Swachhta Pakhwada started with an oath taking ceremony where all the participants pledged to carry forward the cause of 'Clean India, Healthy India'. This event became an important occasion to motivate all the members to adopt cleanliness both in their personal lives and workplace. All the Staff Members, Research Scholars, PDFs and Trainees of Udaipur Solar Observatory / PRL, Udaipur attended this oath taking ceremony and took the Swachhta Pledge.

2. **Cleanliness Drive – Clean Premises, Healthy Environment:** Implementing the philosophy of 'Cleanliness is Service', a massive cleanliness drive was organized by all the staff members, research scholars, PDFs, trainees and contractual workers in the main office premises of USO on the occasion of Swachhta Pakhwada 2025. On this occasion, Senior Professor and Head USO, Prof. Shibu K. Mathew, Member of Swachhta Pakhwada Committee USO, Dr. Rohan Louis, Mr. Abhishek and Mr. Lovjeet Meena led the cleanliness drive in the campus.

Apart from this, cleanliness drive was also carried out at Island Observatory of Udaipur Solar Observatory/PRL situated on the of Fatehsagar Lake.

All the participants spread the message of cleanliness by removing garbage from the shore of the lake. This initiative not only succeeded in ensuring cleanliness of the premises but also contributed significantly in protecting the local environment.

3. **Signature Campaign:** To make the Swachhta Pakhwada more effective, a special signature campaign was organised where all the members pledged to incorporate cleanliness in their lifestyle.

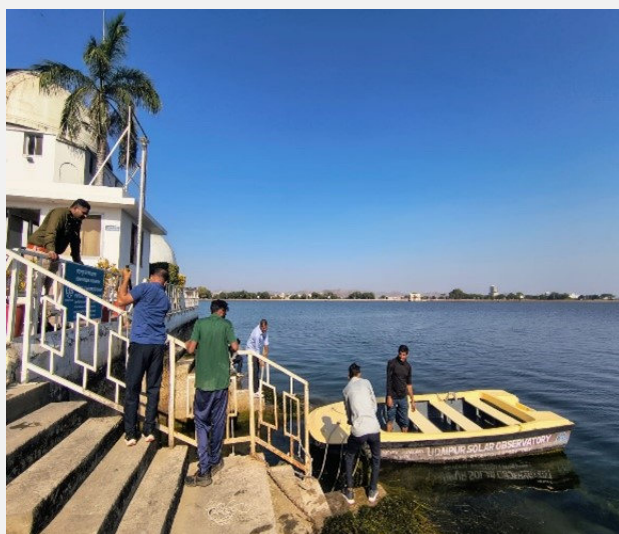
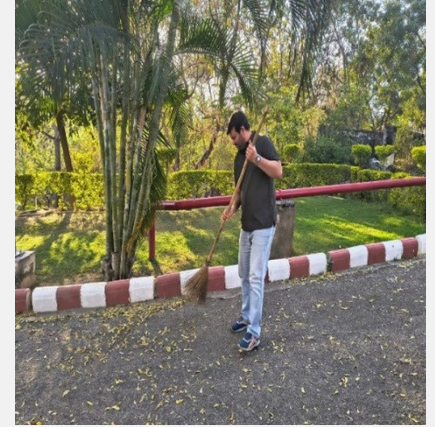
4. **Plantation and distribution of plants – a step towards greenery:** To realize the vision of 'Clean Environment, Green Future', plantation drive also became an integral part of this fortnight. Under this, plants were also distributed to Staff members, Research Scholars, PDFs and Trainees.

5. **Selfie Stand – A new way of cleanliness:** This year, to make the Swachhta Pakhwada more interesting and memorable, a special 'Swachhta Selfie Stand' was set up, where all the participants enthusiastically expressed their commitment towards cleanliness by clicking photos.

6. **Fogging and Fumigation:** Under Swachhta Pakhwada 2025, fogging and fumigation work was carried out in all the premises of USO, Udaipur, which will help in effectively eliminating the targeted insects, mosquitoes etc.

7. **Weeding out of office records – efficiency improvement:** A special weeding out campaign was also organized to increase the efficiency of the office and reduce the load of unnecessary files. On this occasion, a special weeding out campaign of old files was carried out as per the Record Retention Schedule. Senior Administrative Officer Mr. Abhishek led the said sorting campaign.





Glimpses of the event



## Health Check Up (Swachhata Pakhawada 2025)

The Swachhata Pakhawada Celebration 2025 at Dispensary PRL took a thoughtful approach to health and wellness for contractual workers (Housekeeping workers, Labourers, Gardeners etc.). The health check-up program organized from 6th to 14th February was focused on comprehensive preventive care, providing workers an opportunity to monitor and improve their overall health.

The program included several key aspects:

- **Vital Parameters and Clinical Examination:** The workers had their vital parameters such as blood pressure, heart rate, and respiratory rate monitored and received a thorough clinical examination.
- **Pulmonary Function Test (PFT):** This test assessed lung capacity, which is essential for identifying any respiratory issues.
- **Blood Glucose Screening:** Using Random Blood Glucose Measurement, workers were screened for Diabetes or Pre-Diabetes, helping detect potential issues early.
- **Sensitization for Healthy Habits:** Workers were educated about quitting harmful habits such as smoking and tobacco use, with a focus on adopting a healthier lifestyle to prevent lifestyle diseases such as high blood pressure, diabetes, stroke, and cancer.

The activities were spread out over 6-7 days, with a group of 8-10 workers attending each day for their check-ups. The workers were given individual attention, starting with registration by the pharmacist, followed by the collection of personal health histories by nurses, and various diagnostic tests. The final step involved a clinical assessment by the medical officer who provided personalized advice on quitting harmful habits and promoting healthier lifestyles.

In total, 68 contractual workers benefited from the health check-up program. This initiative not only helped detect any existing health issues but also focused on prevention and reducing the risk of future diseases, contributing to the overall well-being of the workers.

It's a great initiative that combines both healthcare and education to ensure long-term wellness, especially in high-risk groups!



Glimpses of the event

## PRL Annual Badminton Tournament 2024-2025 – A Smashing Success!

The highly anticipated PRL Annual Badminton Tournament for 2024-2025 took place on February 16, 2025, at the Kelika Badminton Academy in Ahmedabad. The event brought together enthusiastic players for a day filled with intense competition and sportsmanship. This year, the format was changed from a two-day event to a one-day format, which made the matches more fast-paced and exciting for both players and spectators.

The tournament included three thrilling events: Open Doubles, Open Singles (for both Men and Women), and the fun-filled Lucky Doubles, where partners were randomly paired. With nearly 35 participants, the competition was fierce, showcasing impressive skills, strategic play, and remarkable teamwork.

The Overall Team Championship was awarded based on the highest number of top-four finishes across all categories. After a series of gripping matches, Team PSDN emerged victorious, achieving the most top rankings. The electrifying atmosphere, combined with the high-energy matches, kept everyone engaged throughout the day. Beyond the competition, the tournament fostered camaraderie and team spirit, strengthening workplace bonds.



Glimpses of the event



## 101st PRL Ka Amrut Vyakhyaan (PKAV)



### 'Propulsion Systems for Launch Vehicles and Satellites'



The 101st PRL Ka Amrut Vyakhyaan was delivered by **Dr. V. Narayanan, Secretary of the Department of Space, Chairman of ISRO, and Chairman of the Space Commission**, on February 18, 2025. In this engaging Vyakhyaan, Dr. Narayanan shared his expertise on one of the most crucial components of space exploration, the propulsion systems, with his talk titled 'Propulsion Systems for Launch Vehicles and Satellites.'

Dr. Narayanan started the Vyakhyaan reminding the audience about Dr. Vikram Sarabhai's vision of using space as a transformative tool for the nation's welfare and the efforts he initiated at PRL, which continue to shape India's space program today. Dr. Narayanan emphasized the critical role of propulsion systems in launch vehicles enabling rockets and satellites to reach orbit and further into deep space. He also reminded the audience that ISRO has developed six generations of launch vehicles over the years. With these launch vehicles, ISRO has successfully completed its 100th launch on January 29, 2025. ISRO has not only deployed Indian satellites but also launched 434 satellites from 35 countries, making the nation proud.

He then briefly discussed the evolution and advancement made by India in solid and liquid propulsion systems, starting with the launch of the Rohini-75 satellite in 1967 to the development of the S2 motor for the LVM3 launcher with capacity of 700 kN of thrust using solid propulsion. Subsequently discussed the progress made in liquid propulsion direction, including the development of bi-propellant thrust engines with capacities of up to 800 kN and the current efforts toward the development of a semi-cryogenic engine with a thrust of 2000 kN. He then highlighted the tough journey of developing the cryogenic upper-stage propulsion system for GSLV MkII between 1995 and 2014, and the subsequent development of more advanced cryogenic engines for M3 vehicles. He also covered the ongoing development of the third cryogenic stage propulsion for the Gaganyaan program, enhancements in M3 payload propulsion systems for lifting mass of 5 tons to geosynchronous transfer orbit, and the development of Liquid Oxygen/Methane propulsion systems for the Next Generation Launch Vehicle (NGLV) for lifting mass of 12 to 30 tons to geostationary and low Earth orbits.


He also addressed the initiatives taken for developing air-breathing propulsion systems, which utilize atmospheric oxygen as an oxidizer. Also discussed the various spacecraft propulsion systems and their applications in deep-space exploration and interplanetary missions, including their role in the Chandrayaan, Mars Orbiter, and Aditya L1 missions. He also touched upon the role of the propulsion system on the success of Space Docking Experiment (SpaDeX) on January 16, 2025. Towards the end, he provided insights of the ongoing efforts for developing advanced propulsion systems for the future missions/projects such as the Chandrayaan-4 mission, JAXA Lupex mission, Bhartiya Antriksh Station and the Human landing mission.

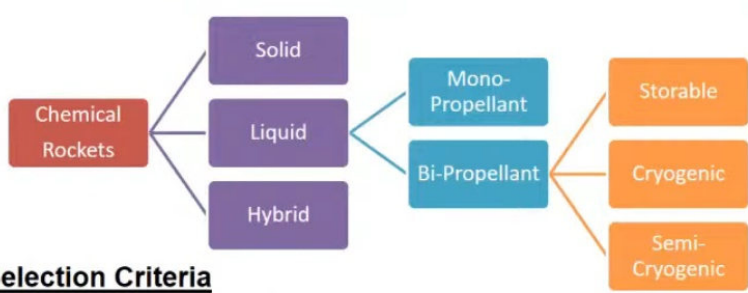
Overall, Dr. Narayanan's Vyakhyaan was very illuminating on India's achievements in propulsion systems and their critical role in advancing India's space programme



Via **webex**  
by CISCO


Launch Vehicle Propulsion






```



graph LR
    CR[Chemical Rockets] --> S[Solid]
    CR --> L[Liquid]
    CR --> H[Hybrid]
    L --> MP[Mono-Propellant]
    L --> BP[Bi-Propellant]
    BP --> ST[Storable]
    BP --> C[Cryogenic]
    BP --> SC[Semi-Cryogenic]
          
```





**Selection Criteria**

- Thrust level & Total Impulse
- Specific Impulse & Density Impulse
- Reusability
- Low Cost
- Core Competency

Available online at: <https://www.youtube.com/live/1SnR1PM6rOw>

## 21वां पीआरएल अमृत राजभाषा व्याख्यान (पर्व)



पीआरएल अमृत राजभाषा व्याख्यान (पर्व) का 21वां व्याख्यान 20 फरवरी, 2025 को के.आर. रामनाथन सभागार में आयोजित किया गया था। इस अवसर पर विशिष्ट वक्ता डॉ. तेजस एस. दोशी, पारिवारिक चिकित्सक, ब्रांड एंबेसडर "स्वच्छता ही सेवा", प्रेरक वक्ता, प्रकृति कार्यकर्ता थे।

The 21st lecture of "PRL Amrut Rajbhasha Vyakhaan (PARV)" was organized on 20th February, 2025 at K.R. Ramanathan Auditorium. The distinguished speaker on the occasion was Dr. Tejas S. Doshi, Family Physician, Brand Ambassador "Swachhta Hi Seva", Motivational Speaker, Nature Activist.

डॉ. दोशी ने अपने कार्यकाल के दौरान 2010-11 में रोटरी क्लब के अध्यक्ष के रूप में कार्य किया, उनके क्लब ने कई सेवा परियोजनाएं पूरी की और कई पुरस्कार प्राप्त किए। वे 2001 से गुजरात – SDRT की आपदा प्रतिक्रिया टीम में शामिल रहे हैं। डॉ. दोशी पीयूष मेडिकल गाइडेंस फाउंडेशन के संस्थापक हैं। डॉ. दोशी ने "डॉट कट द कोर्नर्स" प्रोजेक्ट जैसी परियोजनाएं शुरू की। उन्होंने "इकोब्रिक्स" का उपयोग करके गैर-पुनर्नवीनीकरण प्लास्टिक के निपटान के लिए एक विधि का आविष्कार किया, और उनके मार्गदर्शन में पहला इकोब्रिक पार्क बनाया गया। इसे भारत की सर्वश्रेष्ठ मॉड्यूल परियोजना और भारतीय सरकार की मुद्रित कॉफी टेबल बुक का पुरस्कार मिला। उन्हें कई पुरस्कार और मान्यताएँ मिली हैं, जिनमें टीकाकरण और प्रतिरक्षण में उनके काम के लिए डब्ल्यूएचओ से, स्वच्छ भारत मिशन के लिए भारत सरकार से, और गुजरात के पीएमओ और सीएमओ द्वारा मान्यता प्राप्त है। डॉ. दोशी एक पूर्णकालिक पारिवारिक चिकित्सक हैं और 30 वर्षों से अधिक समय से कार्यरत हैं।

Dr. Doshi served as the President of the Rotary Club in 2010-11. During his tenure, his club completed many service projects and received many awards. He has been involved in the disaster response team of Gujarat – SDRT since 2001. Dr. Doshi is the founder of Piyush Medical Guidance Foundation. Dr. Doshi started the projects like "Don't Cut the Corners". He invented a method for disposing of non-recycled plastics using "Ecobricks", and the first Ecobrick Park was built under his guidance. It has received the Best Module Project of India and Government of India Printed Coffee Table Book award. He has received several awards and recognitions, including from WHO for his work in vaccination and immunization, from the Government of India for the Swachh Bharat Mission, and recognition by the PMO and CMO of Gujarat. Dr. Doshi is a full-time Family Physician and practicing over 30 years.

The vyakhaan was titled "पर्यावरण संरक्षण, स्वच्छता और प्लास्टिक मुक्ति: लोकतंत्र का अनिवार्य कर्तव्य"

व्याख्यान के दौरान डॉ. तेजस एस. दोशी ने बताया कि कैसे हम पर्यावरण को स्वच्छ बनाने के लिए स्वयं के योगदान से शुरुआत खुद से करें। वर्तमान समय में हम जो प्रदूषण के दुष्प्रभावों का सामना कर ही रहे हैं, परंतु भविष्य में परिणाम और भी भयावह होने वाले हैं। डॉ. दोशी ने बताया कि प्रदूषण से लड़ना केवल सरकार की जिम्मेदारी नहीं है बल्कि सरकार के साथ हमें अपनी रोजमर्रा की आदतों में परिवर्तन की आवश्यकता है एवं यह प्रत्येक व्यक्ति का लोकतांत्रिक कर्तव्य भी है। सरकार केवल योजनाएं बना सकती है, उन योजनाओं को सही ढंग से लागू करना हम पर निर्भर करता है।

During the Vyakhaan, Dr. Tejas S. Doshi explained how to make the environment clean, and to start with our own contribution. At present, we are facing the ill effects of pollution, but the consequences are going to be even more dire in the future. Dr. Doshi informed that fighting pollution is not only the responsibility of the government, but also with the government, we need to change our daily habits and it is also the democratic duty of every person. Government can only make schemes; it depends on us to implement those schemes

properly.

प्रस्तुति के बाद, एक चर्चात्मक प्रश्नोत्तर सत्र हुआ जिसने दर्शकों को विषय के बारे में नए दृष्टिकोण और अतिरिक्त विवरण दिए।

Following the presentation, there was a discussion question-and-answer session that gave the audience new perspectives and additional details about the topic.



Glimpses of the event



## हिंदी कार्यशाला- जनवरी-मार्च 2025 तिमाही

21 फरवरी 2025 को जनवरी-मार्च 2025 तिमाही की हिंदी कार्यशाला नैनो सिम्स हॉल में आयोजित की गई। इस हिंदी कार्यशाला में वक्ता के रूप में सुश्री सबा अब्बासी, वरिष्ठ सहायक, क्रय एवं भंडार ने "सामान्य भंडार कार्यप्रणाली एवं संबंधित नियम" विषय पर कार्यशाला दी। कार्यशाला के प्रारंभ में श्री प्रदीप कुमार शर्मा, वरिष्ठ प्रशासनिक अधिकारी ने अपने स्वागत वक्तव्य में राजभाषा में अधिकाधिक कार्य करने का निवेदन किया। विशेष रूप से सोलिस योजना में पुरस्कार प्राप्त सदस्यों से उन्होंने आगे भी हिंदी में कार्यालयीन कार्य में करने की अपील की। इस कार्यशाला के लिए पी.आर.एल. के सभी सदस्यों से ऑनलाइन फॉर्म के माध्यम से पंजीकरण करवाया गया। इस कार्यशाला में प्रशिक्षण प्राप्त करने पर सदस्यों को भंडार संबंधी नियमों के विषय में विस्तार से जानकारी प्राप्त हुई। इस कार्यशाला में कुल 39 सदस्यों ने भाग लिया।

The Hindi Workshop for the quarter January-March 2025 was held on 21st February 2025 in Nano SIMS Hall. In this Hindi Workshop, Ms. Saba Abbasi, Senior Assistant, Purchase & Stores delivered a talk on the topic "General Stores Procedure and Related Rules". At the beginning of the workshop, Shri Pradeep Kumar Sharma, Senior Administrative Officer in his welcome address requested the members to do more and more work in Official Language. An appeal was made to those members who have received awards under the SOLIS Scheme, to do more work in Official Language. For this workshop, the registration of PRL members was done through the online google form. On receiving training in this workshop, the members got detailed information about the Rules related to Stores section. A total of 39 members participated in this workshop.

प्रस्तुति के बाद, एक चर्चात्मक प्रश्नोत्तर सत्र हुआ जिसने सदस्यों को विषय के बारे में नए दृष्टिकोण और अतिरिक्त विवरण प्रदान किए।

After the presentation, a discussion question-answer session was held, which gave the members new perspectives and additional details about the subject.



कार्यशाला की कुछ झलकियां

## **The 1st Professor Ravipati Raghavarao Memorial Lecture**

Professor Ravipati Raghavarao Memorial Lecture has been instituted by the family of Prof. Raghavarao and is administered by PRL as an annual event. Professor R. Raghavarao was an illustrious former faculty of the Physical Research Laboratory (PRL) Ahmedabad during 1966 to 1989 and had made significant contributions to upper atmospheric investigations. He was a pioneer in aeronomy and worked on both theoretical and experimental aspects and is credited with several firsts and discoveries including the topside ionospheric ledges, role of winds in the Equatorial Electrojet, role of vertical winds in the generation of equatorial plasma irregularities and the equatorial temperature and wind anomaly (ETWA). As he was a true PRL'ite in his heart and was genuinely interested in all the fields of sciences being pursued in PRL, his family desired the speaker to be any scientist working in India in any of the fields being pursued in PRL. The selection will alternate between a young and senior scientist every year. The speaker for the first Professor Ravipati Raghavarao Memorial Lecture was selected through an expert committee with a three-layer scrutiny process. The speaker Dr. Sanjib Kumar Agarwala from Institute of Physics, Bhubhaneswar was chosen as the first recipient of this honour in recognition of his significant contributions to neutrino physics.

The event was held on 21 February 2025 wherein Dr. Sanjib Kumar Agarwala delivered his lecture titled "Imaging the Deep Earth with Neutrinos". The lecture focused on the emerging interdisciplinary field of neutrino tomography, which uses neutrinos to study the internal structure and composition of the deep Earth, complementing traditional seismic and gravitational measurements. Dr. Agarwala discussed various ways to study Earth's interior, including gravitational measurements (providing information about mass, moment of inertia, and average density), seismic waves (revealing internal structures and density variations), and neutrinos as a new candidate probe.

Dr. Agarwala explained two main ways neutrinos can be used for tomography:

- o Neutrino absorption tomography: At very high energies (TeV-PeV), neutrinos can be absorbed by the Earth, and the amount of absorption can reveal information about matter distribution. Ice Cube experiment data is being analyzed to see a five-layer structure of the Earth using this method. A 2019 study using Ice Cube data showed the potential to reveal five layers with associated uncertainties in density.
- o Neutrino oscillation tomography: At lower energies, neutrinos oscillate between different flavours. Their oscillation pattern can be modified when they pass through matter due to coherent forward scattering with ambient electrons (MSW effect). Core-passing neutrinos can experience amplified oscillations due to parametric resonance, providing information about the Earth's core.

Dr. Agarwala was presented with a plaque and a citation. The vote of thanks acknowledged the family of Professor Raghavarao for instituting the lecture, PRL management for their support, Professor Sridharan for sharing his memories about Prof. Raghavarao, the nominators and selection committee, and Dr. Sanjib Kumar Agarwala for delivering the insightful lecture.



The Director, PRL, Prof. Anil Bhardwaj informing about the institution of Prof. Ravipati Raghavarao Memorial Lecture



The Plaque and Citation of the first Prof. Ravipati Ravghavarao Memorial Lecture is being presented to Dr. Sajib Kumar Agarwala by Dr. Shoba Boghani and Shri. Ravipati Shanti Sagar the daughter and son of Prof. Raghavarao



Dr. Sajib Kumar Agarwala delivering the first Prof. Ravipati Raghavarao Memorial Lecture



A glimpse of the audience. Several senior PRL Alumni who had come to witness this event can also be seen



## Lab Visit of CSSTEAP Students

Under the aegis of the UN-affiliated Centre for Space Science and Technology Education in Asia and the Pacific (CSSTEAP), the 5th Post Graduate Course on Global Navigation Satellite System (GNSS-05) is currently being conducted by SAC, Ahmedabad. As part of their programme, the students of this course visited the digisonde facility at PRL (Thaltej Campus) on 24 February, 2025.

The CSSTEAP students were very much interested to know about the radio probing technique of the digisonde. Propagation characteristics of radio waves in the upper atmosphere, including their refraction, reflection conditions, and their dependence with plasma frequency and radio signal frequency were explained in detail by Dr. K. Venkatesh. The methodology of digisonde to observe the electron density distribution, formation of different ionospheric layers during day and night time conditions were discussed. Students were very enthusiastic to know about the ionospheric effects on radio wave propagation and the applications of digisonde to identify the maximum usable frequency for long-distance communication. Unique capabilities of digisonde observations to explore various space weather processes were discussed. Dr. Kshitiz Upadhyay, Mr. Pradip Suryawanshi and Ms. Komal of the SPASC division also participated in the discussions.



Glimpses of the event

## PRL Monthly Publications Digest (March 2025)

### Atomic, Molecular and Optical Physics [04]

1. S. Parida, R.K. Kaushal, N. Chauhan, A.K. Singhvi, 2025, Changes in thermoluminescence sensitivity of 110°C glow peak of quartz grains from sediments of River Ganga: Observation and implications, *Earth and Planetary Science Letters*, Date of Publication: 24/02/2025, Impact Factor: 4.8
2. Jyoti, A. Chakraborty, Zhiyang Wang, Jia Zhang, Jingbiao Chen, Bindiya Arora and B. K. Sahoo, 2025, Investigating the  $4D3/2|3,\pm2\rangle - 4D5/2|3,\pm2\rangle$  transition in Nb<sup>4+</sup> for a THz atomic clock, *Phys. Rev. A* 111, 022813 (2025); <https://doi.org/10.1103/PhysRevA.111.022813>, Date of Publication: 21/02/2025, Impact Factor: 3.0
3. Ayan KumarNai, Amritash Sharma, Vimlesh Kumar, Sandeep Singh, Shreya Mishra, C. M. Chandrashekar, and G. K. Samanta, 2025, Beam-splitter-free, device-independent, high bit-rate, quantum random number generator based ontemporal andspatial correlations of heralded single-photons, *AVS Quantum Science*, Date of Publication: 14/02/2025, Impact Factor: 4.2
4. Darshitsinh Parmar, Kavil Mehta, Swetapuspa Soumyashree,Rohit Srivastava, A. K.Sudheer,Prashant Kumar, Prahlad K.Baruah, 2025, Quantitative analysis of trace elements in liquid samples using laser induced breakdown spectroscopy, *Applied Physics B*, Date of Publication: 03/02/2025, Impact Factor: 2

### Astronomy & Astrophysics Division [04]

1. Narendranath Layek, Prantik Nandi, Sachindra Naik and Arghajit Jana, 2025, A Long-term Study of Mrk 50: Appearance and Disappearance of Soft Excess, 2025, *The Astrophysical Journal*, 981, 74 (21 pp), Date of Publication: 27/02/2025, Impact Factor: 4.8
2. N. K. Bhadari; Lokesh Kumar Dewangan; O. R. Jadhav; A. Hoque; L. E. Pirogov; P. F. Goldsmith; A. K. Maity; S. Sharma; A. Haj Ismail; T. Baug, 2025, JWST-ALMA study of a hub-filament system in the nascent phase, *A&A Letters*, Volume 694 (February 2025) *A&A*, 694 (2025) L18; DOI:<https://doi.org/10.1051/0004-6361/202452189> , Date of Publication: 18/02/2025, Impact Factor: 5.4
3. Sanjay Baliwal, Rishikesh Sharma, Abhijit Chakraborty, K. J. Nikitha, A. Castro-González, Hareesh G. Bhaskar, Akanksha Khandelwal, David W. Latham, Allyson Bieryla, Vincent Bourrier, Neelam J. S. S. V. Prasad, Kapil K. Bharadwaj, Kevikumar A. Lad, Ashirbad Nayak, Vishal Joshi, and Jason D. Eastman, 2025, TOI-6038 A b: A dense sub-Saturn in the transition regime between the Neptunian ridge and savanna, *The Astronomical Journal*, Date of Publication: 17/02/2025, Impact Factor: 5.1
4. O. R. Jadhav, Lokesh Kumar Dewangan, Aayushi Verma, N. K. Bhadari, A. K. Maity, Saurabh Sharma, and Mamta, 2025, Uncovering the Hidden Physical Structures and Protostellar Activities in the Low-metallicity S284-RE Region: Results from ALMA and JWST, *The Astrophysical Journal*, 980:133 (14pp), DOI:10.3847/1538-4357/ada388, Date of Publication: 07/02/2025, Impact Factor: 4.8



### Theoretical Physics Division [01]

1. Namit Mahajan and Dayanand Mishra, 2025, Smallness of charm-loop effects in  $B \rightarrow K^{(*)} \ell \ell$  at low  $q^2$ : Light-meson distribution-amplitude analysis, Phys.Rev.D 111 (2025) 3, L031504, Date of Publication: 24/02/2025, Impact Factor: 4.6

### Space and Atmospheric Sciences Division [01]

1. S. Ramachandran and Kamran Ansari, 2025, Influence of changes in anthropogenic and natural sources on global aerosol optical depth during COVID-19 lockdown: Ground-based observations, satellites, models, Atmospheric Environment, Date of Publication: 15/02/2025, Impact Factor: 4.2

### Planetary Sciences Division [03]

1. Ray, D., Das, A., Sarkar, S., Bhattacharya, S. and Nayak, C., 2025, Natrojarosite formed in the Matanomadh Formation, Kutch, India; a Na analog of jarosite on Mars, American Mineralogist, Date of Publication: 26/02/2025, Impact Factor:
2. Shreekumari Patel, Harish, S. Vijayan, M.R. El-Maarry, 2025, A case for young igneous volcanism in the Terra Sirenum region, Mars, Icarus, Date of Publication: 14/02/2025, Impact Factor:
3. K. B. Kimi, S. Vijayan, K. S. Sharini, Harish, S. Tuhi, Anil Chavan, R. K. S. Priya, 2025, Recent Tectonic Activity in and Around the Posidonius Crater, Moon, JGR-Planets, Date of Publication: 12/02/2025, Impact Factor:

### Geosciences Division [01]

1. Amzad H. Laskar, Aharna Sarkar, Ranjan Kumar Mohanty, Rahul Kumar Agrawal, Sanjeev Kumar, A. Shivam, 2025, CO<sub>2</sub> flux and carbon dynamics in soil and respired CO<sub>2</sub> in a semi-arid region of western India, Soil Science Society of America Journal, Date of Publication: 19/02/2025, Impact Factor:

## Awards & Honours

- (1) **Ms. Mansi Gupta**, Senior Research Fellow, Space and Atmospheric Sciences Division, PRL has won the Best Poster Award in the theme- Marine and Terrestrial Biogeochemistry in Frontiers in Geosciences Research Conference (FGRC-2025) held at PRL, Ahmedabad during 5 - 7 February 2025.
- (2) **Ms. Kiran**, Senior Research Fellow, Space and Atmospheric Sciences Division, PRL has won the Best Poster Award in the theme - Climate: Past, Present & Future in the Frontiers in Geosciences Research Conference (FGRC-2025) held at PRL, Ahmedabad during 5 - 7 February 2025.

## Visitors

1. Prof. Mathias Schultheis and Prof. Agnes Georgie Fienga of Observatoire de la Cote d’Azur, Universite Cote d’Azur, France have visited PRL, Ahmedabad from 04.02.2025 to 06.02.2025 in connection with Scientific discussion on Lunar Science in PRL and to extend the further collaborative work on Milky way studies. .
2. Mr. Michael Brian Seed from Elementar UK Ltd., United Kingdon has visited PRL, Ahmedabad from 05.02.2025 to 07.02.2025 for scientific discussion and presentation of latest advancements Elementar has made in technology to support the stable isotope community.
3. Dr. Ravi Kuchimanchi, Association for India’s Development (AID) India visited PRL, Ahmedabad on 06.02.2025 to deliver a talk in the divisional seminar.
4. Dr. Anshika Bansal (Alumni of PRL) from University of Siegen, Germany visited PRL, Ahmedabad from 10.02.2025 to 14.02.2025 for interactions with Scientists and to deliver a talk in the divisional seminar.
5. 30 retired professionals from Senior Citizen Care Charitable Trust of Udaipur have visited Udaipur Solar Observatory (USO), Udaipur on 11.02.2025 to see various scientific facilities at Udaipur Solar Observatory.
6. Dr. V. Narayanan, Secretary, Department of Space and Chairman, ISRO has visited PRL, Ahmedabad on 18.02.2025 to deliver 101st PRL Ka Amrut Vyakhyaan on “Propulsion System for Launch Vehicles and Satellites”
7. Dr. Sanjib Kumar Agarwala, Associate Professor-G, Institute of Physics, Bhubaneswar has visited PRL on 21.02.2025 to deliver 1st Prof. Ravipati Raghavarao Memorial Lecture on “Imaging the Deep Earth with Neutrinos”.
8. Mr. Bhinva Ram a Ph.D. Student from Max Planck Institute for Solar System Research, Germany visited Udaipur Solar Observatory (USO), Udaipur on 24.02.2025 to deliver a talk in the USO Divisional seminar.
9. Dr. Ram Ajor Maurya, Assistant Professor, Department of Physics, National Institute of Technology, Calicut visited Udaipur Solar Observatory (USO), Udaipur from 26.02.2025 to 28.02.2025 to discuss the research work related to ISRO Respond Project and to deliver a talk in the USO Divisional seminar.
10. During February 2025, the following have visited Infrared Observatory, PRL, Mount Abu:-
  - Sub Divisional Magistrate, Mount Abu along with 2 others
  - Three (3) DOS/ISRO staff members,
  - Thiry Six (36) students
  - Thirty Four (34) General Public



## Hearty welcome to our new members



**Name:** MR. VIMALRAJ R

**Designation:** PROJECT ASSOCIATE-I-ANRF

**Date of Joining:** 20.02.2025

**Division:** ATOMIC, MOLECULAR & OPTICAL PHYSICS



**Name:** DR. ABISHEG D

**Designation:** POST DOCTORAL FELLOW

**Date of Joining:** 24.02.2025

**Division:** GEOSCIENCE DIVISION

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