Newsletter of the Physical Research Laboratory

THE SPECTRUM

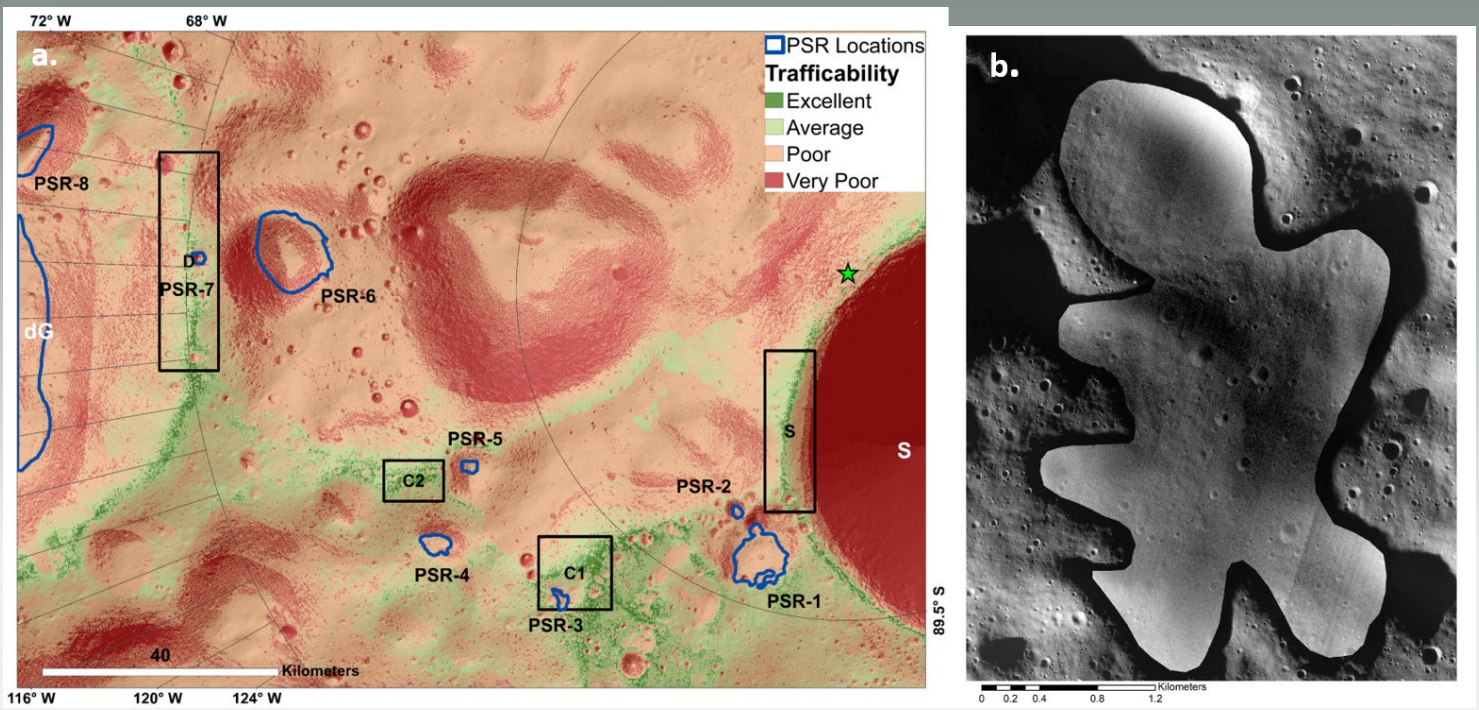

Image of the Month

a. Trafficability map for detecting favourable regions for landing and traversing on lunar south pole region between de-Gerlache to Shackleton craters. b. A contrast enhanced OHRC image of PSR at site-C1 showing its interior overlaid on the original OHRC image onboard Chandrayaan-2.

March 2024

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The Author

Narendranath Layek

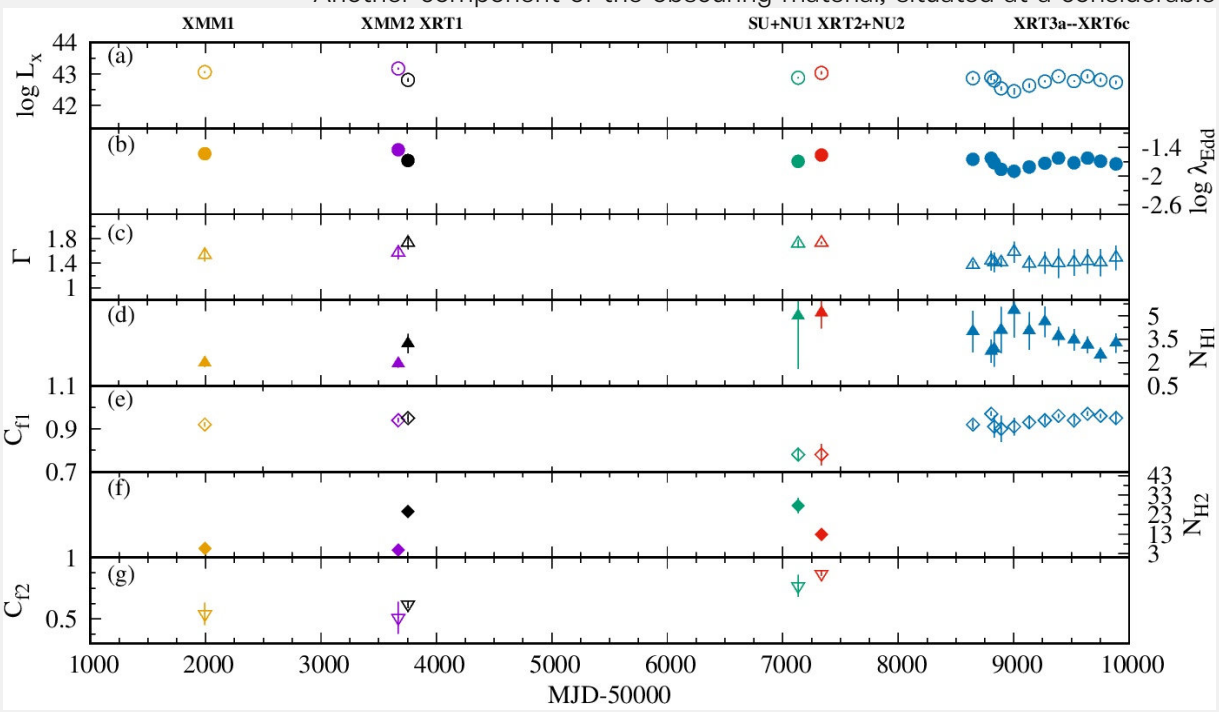
Long-term X-ray temporal and spectral study of a Seyfert galaxy Mrk 6

(***Narendranath Layek***, *Prantik Nandi, Sachindra Naik, Neeraj Kumari, Arghajit Jana and Birendra Chhotaray)*

Active Galactic Nuclei (AGNs) are the extremely luminous and most persistent energetic sources in the universe, powered by mass accretion onto the supermassive black hole residing at the centre of its host galaxy. The X-ray emission from AGN is vital to probe the physical processes in extreme gravity as it is thought to originate from a high-temperature electron cloud called the corona or Compton cloud, situated near the black hole.

We present a long-term X-ray study of a nearby Active Galactic Nucleus Mrk 6, utilizing observations from XMM-Newton, Suzaku, Swift and NuSTAR observatories, spanning 22 years from 2001 to 2022. The temporal study shows fractional rms amplitude (Fvar) below 10 per cent for the shorter time-scale (~60 ks) and above 20 per cent for the longer time-scale (~weeks). A complex correlation is observed between the soft (0.5–3.0 keV) and hard (3.0–10.0 keV) X-ray bands of different epochs of observations. This result prompts a detailed investigation through spectral analysis, employing various phenomenological (Powerlaw, Cutoffpl and Pexrav) and physical (nthcomp and Borus02) models on the X-ray spectra. Based on the overall results obtained from X-ray spectroscopy, we found that the nature of the Compton cloud changed with time. Although Mrk 6 displays characteristics of a changing-look AGN from optical observations, our X-ray spectral analysis did not show any significant variation in the X-ray luminosity and Eddington ratio over a period of 22 years. This indicates that in the X-ray regime, the source did not show any change in its behaviour during the observational period.

We observed a complex variable structure of the obscuring absorber of Mrk 6, with two distinct types of partially absorbers: one neutral and the other ionized. Notably, the partially ionized absorber displays a dynamic behaviour characterized by a rapid change in its location. This component extends towards the narrow line regions or the torus. Our observations trace this ionized hydrogen cloud component until the 2015 dataset, leading us to predict its disappearance between 2015 and 2019. Another component of the obscuring material, situated at a considerable distance from the central engine, remained relatively stable.



Temporal variations of X-ray luminosity (L_X), Eddington ratio (λ_{Edd}), photon index (Γ), hydrogen column density, and corresponding covering factor for two distinct absorbers (NH_1 & Cf_1, and NH_2 & Cf_2) are shown for all the observations used in the present work. The values of (L_X) and (λ_{Edd}) are plotted on a logarithmic scale.

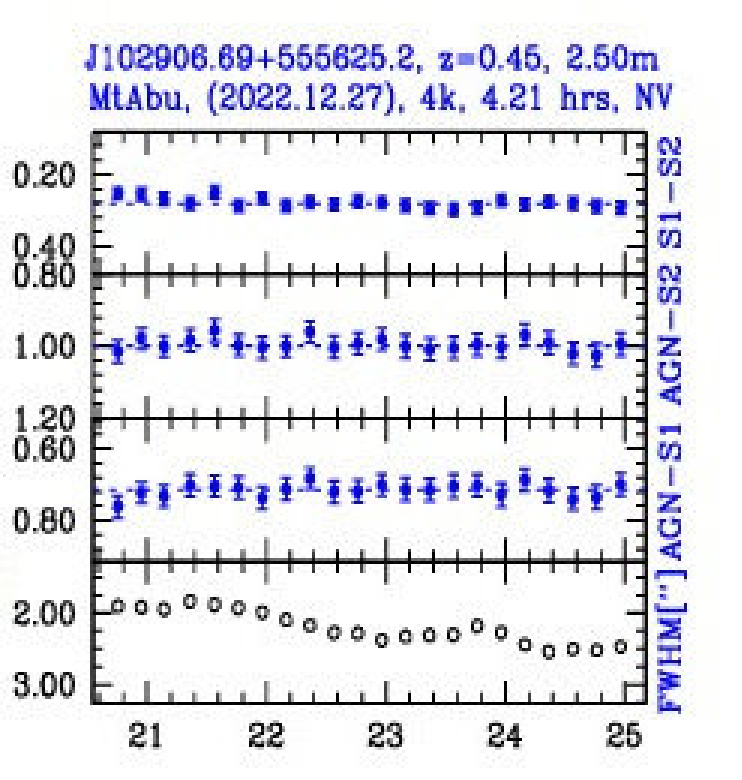
Source/Reference of the Work: https://doi.org/10.1093/mnras/stae299

Probing intra-night optical variability in narrow-line Seyfert 1 galaxies with enigmatic jets

*(Vineet Ojha, **Veeresh Singh**, M. Berton, E. Jarvela)*

Variability studies of active galactic nuclei (AGN) are powerful diagnostic tools to understand the physical processes occurring in the inner regions of AGN that mostly remain unresolved in direct imaging from the currently available telescopes. In our recent work, we studied intra-night optical variability (INOV), for the first time, for a sample of seven peculiar narrow-line Seyfert 1 galaxies (NLS1s). These galaxies have shown recurring flaring at 37 GHz indicating the presence of relativistic jets in them, but no indications of relativistic jets are found at 1.6 GHz, 5.2 GHz, and 9.0 GHz radio observations. Using 1.2m, 2.5m telescopes at Mt. Abu and 1.04m, 1.3m telescopes at Nainital, we performed photometric monitoring observations of these NLS1s and found them to show optical variability on the time scales of a few hours also known as INOV. The duty cycle (frequency of occurrence) of INOV in this sample is similar to that of those NLS1s and AGN which possess relativistic jets. Thus, INOV characteristics of our NLS1s favour the presence of relativistic jet in them and it appears that NLS1s, a subclass of AGN, hosting relatively less massive black holes (10^6 $M_\odot$) can also launch relativistic jets. Although, we caution that the magnetic re-connection in the magnetospheres of their black holes can also be a viable mechanism to give rise to the observed INOV.

Source/Reference of the Work: https://doi.org/10.1093/mnrasl/slae003



The differential light curves obtained from 4.21 hours of monitoring observations with 2.5m telescope at Mt. Abu for a narrow-line Seyfert 1 galaxy named "J102906.69+555625.2" located at redshift 0.45.

The Author

Veeresh Singh

The Author

Sachana Sathyan

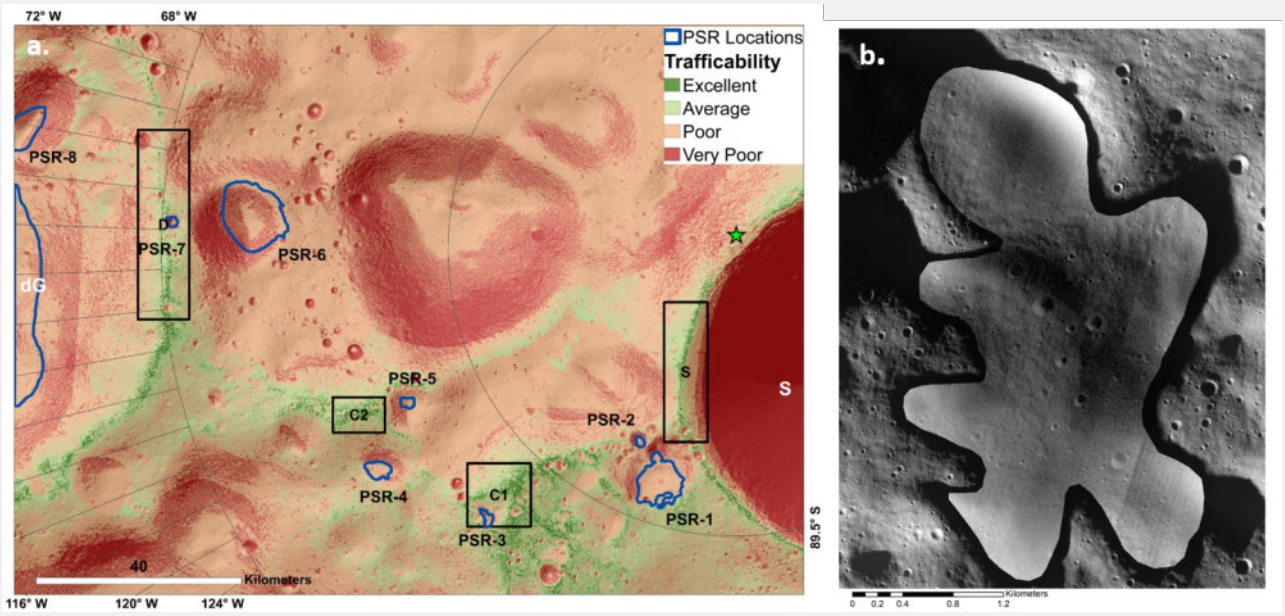
Potential landing sites characterization on lunar south pole: de-Gerlache to Shackleton ridge region

(***Sachana Sathyan***, *Megha Bhatt, Monalisa Chowdhury, Philipp Gläser, Dibyendu Misra, Neeraj Srivastava, Shyama Narendranath, K S Sajin Kumar, Anil Bhardwaj)*

The lunar south pole is a strategic spot for several lunar missions due to its increased likelihood of containing water ice and volatile resources within the permanently shadowed regions (PSRs) resulted from the uneven topography and low axial inclination of Moon. On contrary, this advantage becomes a limitation while considering the technical constraints for a landing mission as landing and surface operations needs comparatively smoother terrain and continuous power. Considering the importance of lunar south pole in volatile exploration and upcoming ISRO-JAXA mission to lunar south pole, we have carried out a comprehensive landing site analysis of a ridge stretching between de Gerlache and Shackleton craters, a location known to provide nearly continuous illumination.

We selected four landing sites; S, C1, C2 and D (shown in Fig. a) spanning across the ridge and evaluated them based on their ability to accommodate a safe landing including slope, illumination, surface roughness, surface temperature, accessibility to nearby PSRs, compositional diversity, and trafficability. The detailed analysis of landing sites suggest that site C1 is the best among all sites. Aided by its high elevation, site C1 can offer a constant line of sight with rover as the landing point is marked at the highest elevated location. Its proximity to a micro PSR (shown in Fig.b), presence of scarps, and OH/H2O-rich mineralogy with hematite deposits in 500 m of vicinity advocate this site to be scientifically enriched for exploration. This site receives the maximum solar illumination and visibility to Earth, a requirement for continuous operation during the lunar days. Through our work, we recommend site C1 as a potential landing candidate which can be considered for future lunar polar landing missions.

Source/Reference of the Work: https://doi.org/10.1016/j.icarus.2024.115988



a. Trafficability map for detecting favourable regions for landing and traversing on lunar south pole region between de-Gerlache to Shackleton craters. b. A contrast enhanced OHRC image of PSR at site-C1 showing its interior overlaid on the original OHRC image onboard Chandrayaan-2.

89th PRL Ka Amrut Vyakhyaan (PKAV)

PKAV-89

The 89th PRL ka Amrut Vyakhyaan titled **"Seven decades of using luminescence in geochronology"** was delivered by **Dr. Frank Pressuer**, Professor, Institute of Earth and Environmental Sciences, University of Freiburg, Germany.

Abstract of the Vyakhyaan

It is now a little more than 70 years ago that Daniels et al. (1953) suggested the use of thermoluminescence (TL) for dating purposes. In the following years, it was a first a research team at the University of Bern and later at Oxford who developed the necessary procedures. The principle of zeroing of the TL signal was later used in the context of volcanic setting but facing several problems such as signal stability with time. The phenomenon that part of the TL is removed by light was first used in Eastern Europe, but the validity of this approach was only established in the late 1970s, mainly by Ann Wintle and David Huntley. While windblown dust (loess) was the main target sediment in the early years, the benchmark publication by Singhvi et al. (1982) highlighted the use of the approach for other deposits. The introduction of optical stimulation in the second half of the 1980s widen the applicability to water-lain deposits. Several methodological breakthroughs since the late 1990s have led to the fact that luminescence is today commonly used in the context of archaeology and geosciences. The key advantages of the method are the common occurrence of quartz and feldspar grains, the main target material, as well as the wide dating range that reaches from few decades to some hundred thousand years (under ideal conditions).

Available online at: https://www.youtube.com/live/7zMBSrb6ugY?si=_RrNY6KALQL814ip

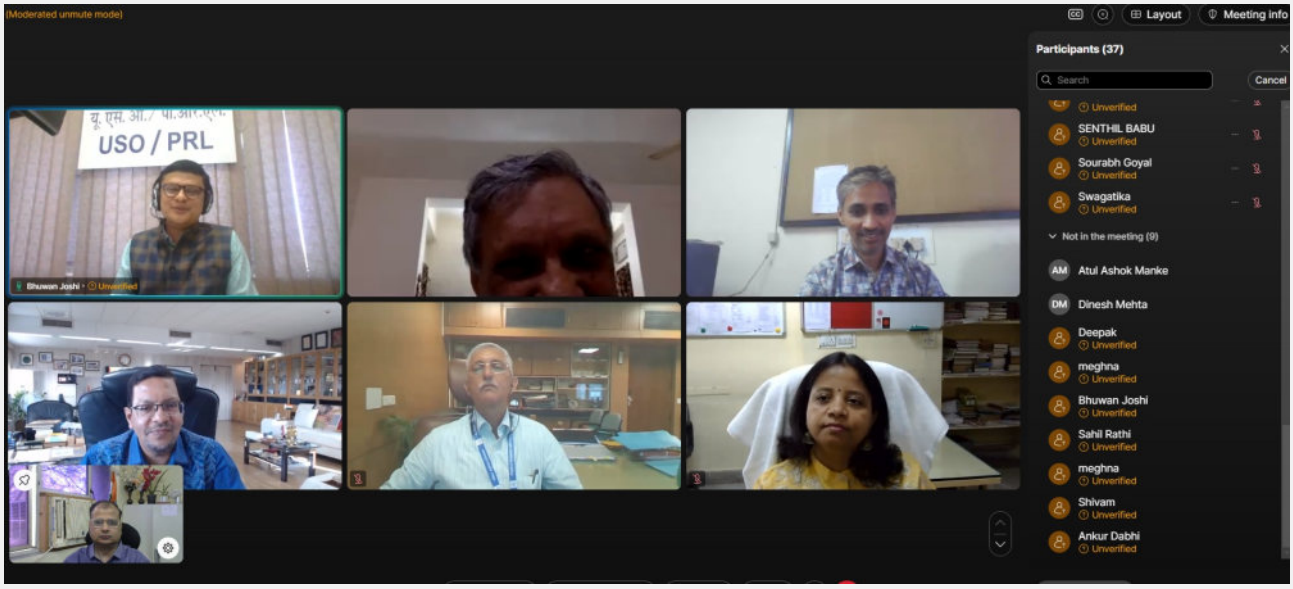
नौवां पीआरएल अमृत राजभाषा व्याख्यान (पर्व)

"पीआरएल अमृत राजभाषा व्याख्यान (पर्व)" का 9वां व्याख्यान 20 फरवरी, 2024 को आयोजित किया गया। इस अवसर के प्रख्यात वक्ता डॉ. प्रेम चंद पांडे, सहायक प्रोफेसर, आईआईटी गांधीनगर थे। भौतिक विज्ञान के अलावा उनका कार्य क्षेत्र समुद्री पर्यावरण, जलवायु परिवर्तन आदि है, डॉ. पांडे ने सैक/इसरो में अपनी सेवाएं दी हैं, उन्होंने 5 वर्षों तक नासा में भी काम किया है। सेवानिवृत्ति के बाद डॉ. पांडे लगभग 20 वर्षों से आईआईटी, खड़गपुर, भुवनेश्वर और गांधीनगर में योगदान दे रहे हैं।
व्याख्यान का शीर्षक था "भारत: ध्रुवीय क्षेत्र में एक उभरती ताकत"।

व्याख्यान के दौरान डॉ. प्रेमचंद पांडे ने बताया कि भारत ने अंटार्कटिका जोन का अपना पहला कदम 1981 में उठाया, जिसकी देखभाल खुद पूर्व प्रधानमंत्री श्रीमती इंदिरा गांधी ने की। पहले अभियान के नेतृत्व के लिए डॉ. एस. ज़ेड. कासिम, जो एन.आई. ओ. के तत्कालीन डायरेक्टर थे, उनको चुना गया। यह पूरा अभियान डी.ओ.डी.के तत्वावधान में किया गया। उन्होंने यह भी बताया कि आज चार दशकों के बाद भारत के दो स्थाई स्टेशनों भारती और मैत्री में 24*7 सुचारु रूप से काम हो रहा है और ध्रुवीय विज्ञान के विभिन्न पहलुओ में गहन अध्ययन चल रहे हैं जिनमें देश–विदेश के ढेर सारे वैज्ञानिक भाग ले रहे हैं। भारत अंतरराष्ट्रीय मंच पर अपना पक्ष मजबूती से रख रहा है और अनुसंधान का दायरा भी बढ़ा दिया है।
एक आकर्षक प्रश्नोत्तर के माध्यम से, श्रोताओं को विषय के बारे में अधिक जानने और नए दृष्टिकोण प्राप्त करने का अवसर मिला।

The 9th lecture of "PRL Amrut Rajbhasha Vyakhyaan (PARV)" was held on February 20, 2024. The eminent speaker for the occasion was **Dr. Prem Chand Pandey**, Adjunct Professor, IIT Gandhinagar. Apart from material science, his work area is ocean environment, climate change etc., Dr. Pandey has served at SAC/ISRO. He has also worked in NASA for 5 years. After retirement, Dr. Pandey has been contributing to IIT, Kharagpur, Bhubaneswar and Gandhinagar for almost 20 years.
The lecture was titled "भारत: ध्रुवीय क्षेत्र में एक उभरती ताकत"।

During the lecture, Dr. Prem Chand Pandey informed that India took its first step towards Antarctica Zone in 1981, which was looked after by the former Prime Minister Mrs. Indira Gandhi herself. Dr. S. Z. Qasim, who was the then director of NIO, was selected to lead the campaign. This entire expedition was carried out under the auspices of D.O.D. He also informed that today after four decades, two permanent stations of India, Bharati and Maitri, are working 24*7 and conducting in-depth studies on various aspects of polar science in which many scientists from India and abroad are participating. India is strongly presenting its stand on the international platform and has also increased the scope of research.
Through an interesting Q&A, listeners were able to learn more about the topic and get fresh viewpoints.



कार्यक्रम की कुछ झलकें

ऑनलाइन उपलब्ध है: https://www.youtube.com/live/ELyY2AHaWFU?si=U-uYNm7YPU8ZJ5CX

PRL Inter Division Volleyball Tournament 2024

Volleyball is one of the oldest and most popular sports being played in the Physical Research Laboratory (PRL), Ahmedabad. PRL Inter Division Volleyball Tournament 2023 was organized among 6 teams (i.e., ASTAS, AMOPH, GSDN + Services, PSDN + USO, SPASC, and THEPH + Admin). The tournament was an exceptional display of hustle, fight, competition, and most importantly sportsmanship. The tournament started with a Veterans Match between the Dean's Team and Registrar's Team, showcasing the volleyball skills of PRL veterans. The winner of the Veterans Match was Dean's Team. After an extraordinary 15 league matches with many nail-biting encounters, the top three teams that qualified for the knockout stages were decided only on the last day of league matches. SPASC finished at first position qualifying directly to the finals. ASTAS and (THEPH + Admin) finished at second and third positions, respectively, squaring off to face each other in the eliminator. THEPH + Admin won the eliminator, qualifying for the finals and setting the stage for the epic final match. The final match was played between SPASC vs (THEPH + Admin) on 20th February 2024 in the presence of Prof. Anil Bhardwaj (Director, PRL), Prof. D. Pallamraju (Dean, PRL), and PRL members gathered to witness the thrilling final clash. The final match included the cake-cutting event by the Director, PRL. In the thrilling final match, SPASC won against THEPH + Admin with a commanding score of 3-0. With this win, SPASC has clinched the PRL Volleyball Tournament for the second consecutive year, showcasing their absolute dominance throughout the tournament by not losing even a single set. In the prize distribution, Honorary, Veteran, Referee, Runner-up, and Winner trophies and medals were distributed by the Director, PRL. We congratulate all the participants & winners and look forward to continuing success in their journey in the future.

Clicks of the Final

4th CNIT Division Nukkad – Chai Pe Byte on "Introduction to PRLNabh"

The 4th CNIT Division Nukkad – Chai Pe Byte on "Introduction to PRLNabh" was held on February 28, 2024, in hybrid mode from 15:00 hrs to 16:00 hrs. There were a total 47 (23 at main campus and 22 at Thaltej campus, 02 at the USO campus) participants who attended the session. In the session, 70% discussion was held in Hindi and 30% discussion was held in English.

The main objective of the initiative "Chai Pe Byte" is to share the experiences & knowledge, understand users' IT related problems, find the possible solutions and strengthen the overall bonding between CNIT Division and PRL colleagues, which in turn will improve the overall functioning of PRL IT services/facilities.

Mr. Jigar Raval welcomed all participants in the 4th session of CNIT Division Nukkad – 'Chai Pe Byte on "Introduction to PRLNabh" and briefed the objective of the session. Mr. Prashant Jangid presented and demonstrated PRL's new updated own file sharing service – PRLNabh. The service has been set up using open source tool – Nextcloud. Mr. Vaibhav Rathore coordinated the session at the Thaltej Campus. The presentation covers the brief about the new major features of PRLNabh, file sharing and collaborative document editing, form creation, and its overall security. Dr. Bhushit, Mr. Shashikant and all CNIT colleagues actively provided their support during the testing of the service before Go-Live.
Following are the salient features of the service:

1. The service has been hosted in PRL IT data center at the Thaltej Campus.

2. The 200TB storage of old Vikram-100 HPC has been utilized to set up the service.

3. The PRLNabh service is available for all the permanent employees of PRL. The user has to send an email request to avail the service.

4. All authorized users can use it to share files/documents with collaborators over the Internet.

5. All the registered users will get a 20GB default storage quota. However, based on the requirement of the user and the availability of the total storage on the system, the CNIT team will accordingly increase the user's storage quota.

6. Due to system-level storage limitation, CNIT will not take a backup of users' data.

7. The user can do online editing of documents through Collabora online.

8. The service has been secured using open source tools like IPTables (Firewall), Mod Security (Web Application Firewall), Fail2ban (for Login/Password brute force attack prevention, Denial of Service (DoS) prevention), OTP (for Multi Factor Authentication) etc.

All the participants have appreciated the new file sharing service with larger data storage capacity, collaborative document editing, and online form generating feature. CNIT team thanked Dr. Partha Konar, Dr. Bhushit Vaishnav, Dr. Shashi Prabhakar for their valuable inputs to add new features.
CNIT team sincerely thank Director, PRL, for his constant guidance and motivation to initiate such activities in different IT verticals. We thank Dean, PRL and Registrar, PRL for their support. We thank Prof. Bijaya Sahoo, Prof. Varun Sheel and Prof. Namit Mahajan for their guidance and support in all the IT related activities and projects. From the bottom our hearts, we thank all the participants who enthusiastically participated, provided their valuable feedback and encouraged us to conduct similar

events in future. We also thank all the PRL users for their cooperation and help. The report is also available on CNIT Division Website under Intranet Access URL: https://www.prl.res.in/prl-eng/cc/intranet/chaipebyte.

Glimpses from the event

International Conference on Planets, Exoplanets and Habitability

The International Conference on Planets, Exoplanets and Habitability was held at PRL during 5-9 February 2024 (https://icpeh.ipsa-asso.in/). This was the first international conference held at PRL after Chandrayaan-3 success and after the first discovery of exoplanet by astronomers of PRL. This week-long multidisciplinary conference covered research topics focused on planets and exoplanets studies and their link to habitability. This conference aimed to provide a platform for researchers, professionals, and students from around the globe to exchange knowledge, discuss advancements, and foster collaborations in the field of planets and exoplanets. This is the first such conference organized at PRL covering a broad range of topics.

The conference witnessed active participation within the country and abroad. A total of 262 delegates registered for the conference and 200 abstracts were submitted. A total of 25 delegates participated from outside India from USA, UK, UAE, France, Italy, Germany, Chile, Switzerland, Hungary, Egypt, Japan, Netherlands, Bangladesh, and Israel. After evaluation of abstracts, 100 were assigned for oral presentation, which included 21 solicited talks and 81 were assigned to poster session. In addition to this, the conference welcomed master's level students, providing them with a unique opportunity to engage with experts. The interactions during breaks, poster sessions and during the questions and answer sessions offered invaluable insights and guidance to students. The inclusion of master's level students further enriched the conference by fostering a diverse and inclusive environment for knowledge exchange.

The conference included a public lecture delivered by Prof. Michel Mayor, Nobel Laureate, Geneva Observatory, Switzerland. His insights and expertise on the search for planets similar to our Earth sparked engaging discussions. Two special lectures were organised on Small Bodies in our Solar System and How to build a habitable planet by Dr. Mohamed Ramy El-Maarry and Dr. Elizabeth Tasker, respectively.

Group photo of the participants

As part of the conference program, a vibrant cultural evening was organized at the PRL Thaltej campus on February 7, 2024. This event provided glimpses of Indian music, and dances. Corporate Participants of the conference, namely AMOS, ATOS, HHV, AHV, and Luma Optics were given a platform to address the audience during the cultural evening. Committee on Space Research (COSPAR), International Lunar Exploration Working Group (ILEWG), and Indian Planetary Science Association (IPSA) supported the conference by providing funding to students and early career researchers.

The early career participants were recognized by giving away prizes in the categories of best poster and best oral presentation in the three broad themes of the conference, namely, planets, exoplanets and habitability.

Glimpses of the event
at K.R. Ramanathan Auditorium, Navrangpura campus, PRL

9th Topical conference on Ultrafast Photonics and Quantum Science

The 9th Topical Conference (TC) of the Indian Society of Atomic and Molecular Physics (ISAMP) was held in the Navrangpura campus of PRL, Ahmedabad during 15-17 February 2024. The theme of the conference was “Ultrafast Photonics and Quantum Science.” This theme was proposed to keep account of ongoing research at PRL and its importance in national and international perspectives. The primary motivation of this conference was to bring researchers from diverse areas of ultrafast photonics, lasers, and quantum technologies on the same platform to cross-pollinate their scientific ideas.

Ultrafast photonics topics are related to the study of light and its interaction with matter on short timescales, typically less than a picosecond. This includes investigating processes that occur in atoms and molecules. The 2023 Nobel Prize in Physics was awarded to three physicists (of Ultrafast Photonics), Pierre Agostini, Ferenc Krausz, and Anne L'Huillier, "for experimental methods that generate attosecond pulses of light for the study of electro dynamics in the matter." At PRL, the ultrafast atomic, molecular physics research started in year 2016 by establishing a world-class Femtosecond laser lab in the Atomic Molecular & Optical Physics Division, although the research on atoms and molecules started in 1970, and the Indian Society of Atomic and Molecular Physics (ISAMP) was registered at PRL in 1981. Thus, PRL has contributed a lot in the field of atomic and molecular physics that has been currently enriched by ultrafast atomic and molecular physics. At PRL research in Quantum Optics was initiated in 1997 by the then Director, PRL, Prof. G. S. Agarwal and now the institute has many groups contributing significantly to the experimental and theoretical Quantum Science and technology. The theme “Quantum Science” was proposed to bring experts to share their ideas not only on fundamental science but also to discuss India’s National Quantum Mission and how the community could deliver. PRL scientists have already demonstrated the free-space quantum communication for a few hundred meters and now gearing towards Satellite-based quantum key distribution. Laboratory activities are going on towards photonic quantum computing and quantum sensing as well. There is a lab working on defect centres in crystals, which holds great promise for quantum sensing. This prestigious meeting was an opportunity for researchers to interact and share their research experience, and ideas with distinguished scientists working in diverse areas of Ultrafast Photonics and Quantum Science and Technology.

Highlights

• 115 participants (35-faculty, 65-Students & Postdoc, 15-corporate participants) from several academic and research institutes, Universities, CSIR labs., IIT’s, IISER, IIST, and ISRO units attended this conference.

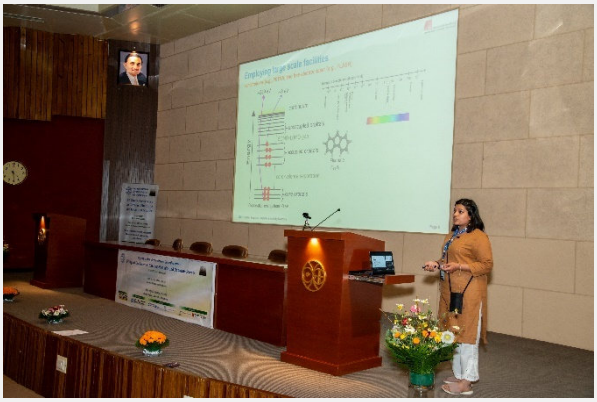
• There were ten scientific sessions with 33 talks, including two (2) plenary talks, twenty-six (26) invited talks, four (4) student/contributory talks, one (1) vendor talk, and one (1) colloquium.

• There were 49 posters presented in the conference. 5 posters were selected as best posters.

• Multiple talks on Ultrafast photonics, attosecond science, Quantum science and technology were presented.

In summary, the 9th Topical Conference on Ultrafast Photonics and Quantum Science was a very successful science event that helped many young researchers who shared their ideas with experts of ultrafast, attosecond, Quantum science, and technology.

Group photo of the participants



Glimpses of the event
at K.R. Ramanathan Auditorium, Navrangpura campus, PRL

5th Workshop on Luminescence Dating and its Applications (WLDA-2024)

Luminescence has emerged as an important dosimetry and geochronology tool in the last few decades. Its importance can be gauged from the fact that publications using luminescence has grown exponentially in the past few decades. Luminescence dating is used by researchers involved in study of earth surface processes, paleoclimate, landform evolution archaeology etc. for establishing chronology of the events while luminescence dosimetry finds application in retrospective, accident and space dosimetry, which is useful for Indian space program. It had been extremely useful in studies related to human evolution, estimating rates and magnitudes of earth surface processes, studies related to natural hazards like floods and earthquakes.

Luminescence community has grown significantly worldwide as well as in India. The first luminescence-dating laboratory of country was established in Physical Research Laboratory (PRL) Ahmedabad, which is at present the biggest and best-equipped laboratory in India for luminescence dating. Following this, more than 13 research laboratories were established in different parts of India. Further plans are there to extend the facilities in other parts of the country. PRL, being the institution where the dating technique was initiated, hosts dedicated faculty and excellent research laboratories. The state of the art laboratory facilities have continuously kept pace with advancements in physics, radiation dosimetry, planetary sciences and geological applications of the luminiscence technique.

The 5th workshop on luminescence dating and its applications (WLDA-2024) was hosted by the Physical Research Laboratory, Ahmedabad during 21-23 February 2024. A pre-workshop hands-on training session was held at the Institute of Seismological Research (ISR) on 20th February 2024. These were held under the auspices of the Association of Luminescence Dating (ALD). The pre-workshop training and workshop received an overwhelming response. The pre-workshop was attended by more than 50 participants. While, more than 120 participants from different parts of the country participated in the workshop at PRL. There were about 20 Keynote lectures on the luminescence basics, advanced methodologies and applications along with several oral talks on interesting research areas of luminescence dating and applications.

The pre-workshop started with fieldwork in Sabarmati river section, near ISR campus. In this, the geological settings of the river section was discussed by geologists from ISR followed by discussion on sampling methodology, hands on experience of sample collection by participants. Fieldwork was

followed by lectures on basics of luminescence technique covering the aspects of physics of luminescence mechanism, luminescence dosimetry, dating, and dose rate estimation for quartz and feldspar by different luminescence experts. The day concluded with long discussions on solving doubts of the participants related to basics of luminescence technique.

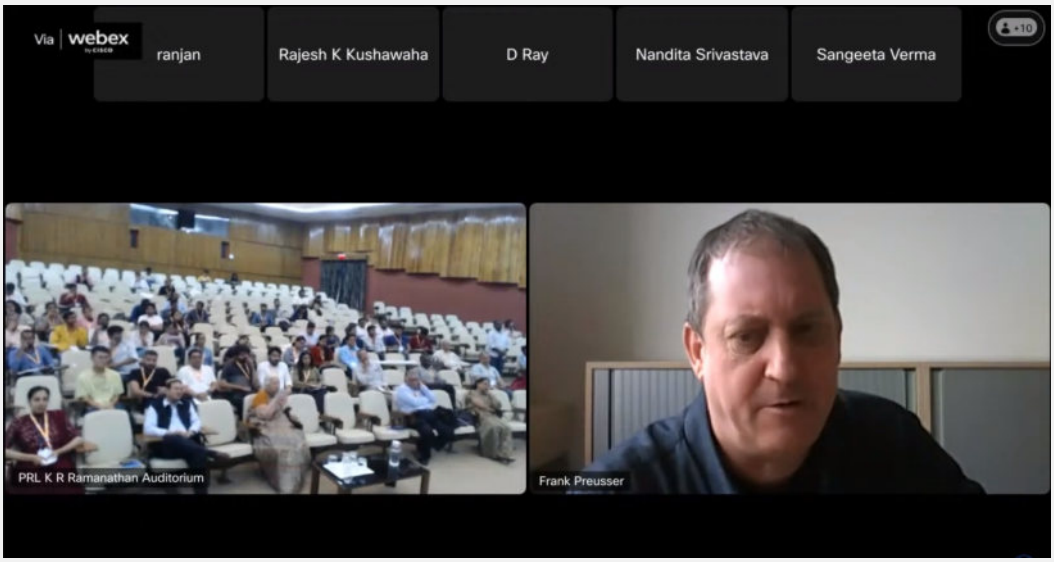
Group photo of the participants

The inaugural program of WLDA-2024 was held on 21 February 2024 and attended by several eminent dignitaries and participants. Prof. Anil Shukla, Chair of Local organizing committee greet all the guests. The workshop was inaugurated by lightening the lamp by dignitaries comprising of Prof. Anil Bhardwaj (Director PRL), Prof. A. K. Singhvi (Patron of Workshop), Prof. D. Pallam Raju (Dean), Prof. R. D. Deshpande (Registrar), Prof. R. P. Singh (Chairman AMOPH Division), Prof. A.D. Shukla (Chair LOC), Prof. Shiela Mishra (Deccan College, Pune), Dr. M.K. Murari (ALD President) and Dr. Naveen Chauhan (Convener). Prof. Anil Bhardwaj welcomed all the participants and shared his thoughts about the luminescence research. Following this, Shri. A. S. Kiran Kumar, Chairman, PRL Council & Chairman, APEX Science Board of ISRO delivered thought provoking inaugural address and shared his thoughts about the luminescence research, future direction of research and need of hour for the research. Dr. M.K. Murari and Dr. Naveen Chauhan gave an overview of ALD and workshop respectively. Following this, Prof. A.K. Singhvi, Patron of the workshop, delivered an insightful talk on “Recounting Five Decades of Cohabitation with Luminescence Dating”, in which he discussed about the journey of growth of luminescence technique in India from early stages, current scenario and the future directions for new generation. The inaugural session concluded with vote of thanks by Dr. Shubhra Sharma (Co-Convener) of the workshop.

Glimpses of the inaugural session
at K.R. Ramanathan Auditorium, Navrangpura campus, PRL

The day 1 of the workshop focussed mainly on the luminescence Physics and new developments. There were sessions on 'advances in luminescence signals' discussing newly explored luminescence signals as Infrared Radiofluorescence (IR-RF), Infrared Photoluminescence (IR-PL) and post-Violet IR stimulated luminescence (pVIRSL) and 'methodological developments' discussing new methods for luminescence applications. Following these, renowned geologist Prof. Frank Preusser delivered an online colloquium on 'Seven decades of using luminescence in geochronology' in **PRL Ka Amrut Vyakhyan series**. In this Prof. Preusser discussed the developments in luminescence technique since its beginning.

The day 2 of the workshop covered the Glacial and fluvial applications of luminescence dating. In these, the keynote speakers gave an overview about the applications and the challenges of luminescence dating use in the geological settings. There were discussions on debates and the reconciliation in Himalayan Quaternary Glaciation and new dating results for Himalayan Glaciation were presented. In fluvial studies sessions, the luminescence dating results for fluvial sediments from different parts of country were presented. There were discussions on critical zone science, evolution of Himalayan front, fluvial dominated lake deltas, coastal fluvial setting of southern India and comparison of luminescence sensitivity variations across different river systems.



PRL ka Amrut Vyakhyan delivered by Prof. Frank Preusser

Besides these, there was a session on emerging new fields in luminescence technique and poster

session. The emerging field session discussed new techniques as rock surface exposure dating, luminescence thermochronology and provenance studies using luminescence presented by eminent researchers from India and abroad.

About 60 students and faculties from different university or institutes of India presented their research work in a vibrant poster session under the themes of Advances in Luminescence Technique: New Signals and Methodology, Fluvial Applications, Glacial Applications, Archaeological Applications, Tectonic Geomorphology and Paleo-Seismology. The posters were designed to highlight the research works and to seek expert advises on use of luminescence for establishing chronology in participant's research areas. Several researchers sought the expert advice on possibility of using luminescence for their ongoing or planned research works.

Day 3 comprised of sessions on luminescence applications to Archaeology, Tectonic Geomorphology and Paleo-Seismology and Radiation Dosimetry. Eminent researchers from respective fields gave keynote address providing current update for each field in Indian context. The presentations were delivered on potential applications and possibilities of luminescence technique in Indian archaeology, geology and space missions. The last session of day 3 had discussions on Laboratory Standardization and Panel Discussion about new collaborative projects and issues faced by the users. In this, representatives from different luminescence laboratories of India presented ongoing activities of their laboratory and discussed about collaboration opportunities with the participants.

Finally, in the closing ceremony best poster awards were given to Ph.D. students in Physics, Geology and Archaeology category. The resource persons and keynote speakers were felicitated by the Director, Dean and Registrar, PRL and Prof. A.K. Singhvi, Patron of workshop. Further at the end Prof. A. K. Singhvi was felicitated by prof. Anil Bhardwaj on behalf of ALD.

Swachhta Pakhwada 2024

The Swachhta Pakhwada was celebrated at Physical Research Laboratory (PRL) from February 1st to 15th, 2024, as per the directives received from Director CEPO/ Nodal Officer, SAP on "Swachhta Action Plan 2024", which states that "Swachhta Pakhwada" is to be organized from February 1st to 15th, 2024 in the Department of Space and DOS Centres/Units with the main focus on "Swachhta everyone's business".

PRL members took the Swachhta Pledge as part of the Swachhta Pakhwada on February 1, 2024. An online quiz competition was held to celebrate Swachhta Pakhwada 2024. Employees and contractual workers participated in Swachhta Rally drives at the PRL Main Campus, Thatlej Campus, USO Campus and MIRO Campus. Swachhta Signature Campaigns were held at PRL Main Campus and Thaltej Campus. A drawing competition was organized at Vinoba Bhave Municipal Saraswati Mandir. We conveyed and promoted awareness among the school children about the significance of cleanliness and hygiene. Further, jute bags were distributed to them.

To ensure cleanliness and hygiene, water tanks, sewage lines, and artificial ponds at office campuses and residential colonies were cleaned on a regular basis. Fogging and fumigation were carried out as part of the Swachhta Pakhwada Campaign during the Pakhwada season on all PRL campuses and residential colonies. Furthermore, it would be a regular interval year-round scheduled activity.

PRL is committed to promoting and disseminating information on cleanliness, hygiene, and sanitation. We emphasize maintaining a clean and green environment at PRL's campuses. We believe that a clean and healthy environment is essential for the well-being of every human being. Our devotion to cleanliness extends beyond the physical infrastructure of our campuses. PRL members are equally devoted in fostering cleanliness in their personal and professional life.

Snaps of the event

PRL Annual Badminton Tournament 2023-24

Physical Research Laboratory has conducted the Annual Badminton tournament during 17th and 18th February, 2024 at the Kelika Badminton Academy in Ahmedabad. Over two spirited days, employees from various divisions showcased their badminton prowess, fostering workplace unity and promoting a healthy lifestyle.

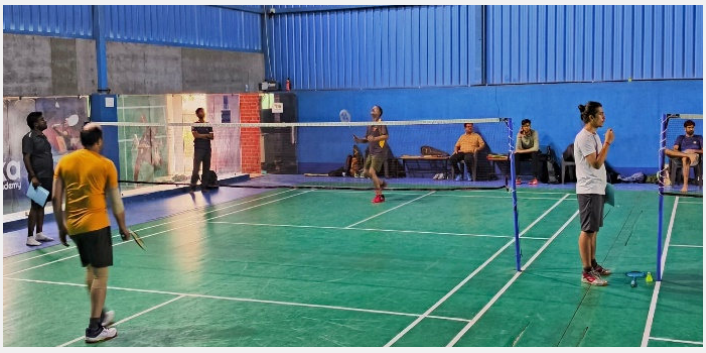
The tournament featured an array of events catering to various skill levels and interests, including Women's Singles, Lucky Doubles, and Veterans Singles alongside traditional open singles and open doubles matches. Team events were also held. This provided ample opportunities for participants to exhibit their athleticism and sportsmanship. Players from each department exhibited remarkable agility and strategic prowess, captivating both their colleagues and spectators with intense matches and thrilling rallies. The camaraderie among players was palpable as they cheered each other on and celebrated the spirit of friendly competition.

The inclusion of Lucky Doubles injected an element of excitement by pairing players randomly, leading to unexpected yet thrilling partnerships. Veterans Singles provided a platform for seasoned players to showcase their experience and proficiency in the sport.

With approximately 50 enthusiastic participants, the tournament demonstrated its immense popularity and appeal among employees and students of PRL. This significant turnout underscores the widespread interest and enthusiasm for the event.

As the tournament drew to a close, it left a lasting impact on the PRL community, fostering stronger bonds and a sense of teamwork among colleagues. Beyond promoting physical well-being, the event emphasized the importance of collaboration and healthy competition in the workplace.

Some captivating photos and the results of the tournament are shown, capturing the excitement and camaraderie of the tournament, serving as cherished memories for all participants involved.



Glimpses of the tournament held at Kelika Badminton Academy.

EVENT CATEGORIES	Results		
	Winner	Runner up	Third Place
VETERANS	ATUL ASHOK MANKE	SENTHIL BABU T J	SANJAY S WAIRAGADE
Women Singles	MONIKA DEVI	ANKITA PATEL	*****
Men's Singles	VAIBHAV KATYAL	ARAVIND K	A. SHIVAM
Open Doubles	A. SHIVAM RAM LAKHAN AGRAWAL	ARAVIND K ANKIT KUMAR	R P SINGH DHARMENDRA KAMAT
Lucky Doubles	DHARMENDRA KAMAT SANJAN ROY CHOWDHURY	A. SHIVAM ARAVIND K	R P SINGH RAM LAKHAN AGRAWAL
Team Event	SPASC R P SINGH DHARMENDRA KAMAT JACOB SEBASTIAN ANKIT KUMAR SUNIL KUMAR	GSDN A. SHIVAM DEVA PRASAD	AMOPH VAIBHAV KATYAL SANTUNU KUMAR PANDA SAHIL RATHI BAKTHI RANJAN JENA

Results of the tournament

Group photo of the participants

PRL Exhibition at NSSS-2024, Goa University

The National Space Science Symposium (NSSS)-2024 was organized at Goa University, Goa, during 26 February-1 March 2024. An exhibition center/stall was set up by PRL during the entire symposium period. A total of 9 posters on frontline research activities, including both ongoing and future programs of various science and Research and Development (R&D) projects, use of quantum technologies being undertaken in different divisions of PRL were displayed.

A continuous onsite screen display (Audio + Video-setup, movies) about the history and evolution of research programs at PRL, landmark achievements, glimpses of laboratory experiments, contributions to space programs, etc. was also arranged. In addition, PRL brochures, key rings, stickers, and leaflets on various frontline research programs/projects (such as the VOC Atmospheric Laboratory, Indian Lidar Network Programme, Solar X-ray Monitor (XSM), Alpha Particle X-ray Spectrometer (APXS), Aditya Solar Wind Particle Experiment (ASPEX), Indian Planetary Science Association (IPSA), PRL booklet, Compound Astronomical Low cost Low frequency Instrument for Spectroscopy and Transportable Observatory (CALLISTO), Global Oscillation Network Group (GONG), Multi-Application Solar Telescope (MAST), Chandra's Surface Thermophysical Experiment–ChaSTE). etc. were distributed.

Several of PRL faculty & staff members, postdoctoral fellows, and research fellows participated and took responsibilities of the exhibition booth from 9 AM to 7 PM throughout the 5 days to interact with not only the delegates of the NSSS-2024 visiting our stall but also the host of visitors, school and college students, parents, who had come in large numbers. PRL sincerely thanks the NSSS-2024 Local Organizing Committee (LOC) and Faculty & Staff members of Goa University for providing the space and other facilities to set up an exhibition stall. Thanks are due to the Director, PRL, Prof. Anil Bhardwaj & Dean, PRL, Prof. D. Pallamraju for all their support and encouragement (Courtesy: Prof. L. K. Sahu).

PRL stall at Goa University

PRL Monthly Publications Digest (February 2024)

Astronomy & Astrophysics Division [3]

1. Narendranath Layek, Prantik Nandi, Sachindra Naik, Neeraj Kumari, Arghajit Jana, Birendra Chhotaray, 2024, Long-term X-ray temporal and spectral study of a Seyfert galaxy Mrk 6, 2024, Monthly Notices of the Royal Astronomical Society, 528, 5269–5285, Date of Publication: 16/02/2024, Impact Factor: 5

2. Sharma, Saurabh, Verma, Aayushi, Mallick, K., Dewangan, Lokesh Kumar, et al., 2024, Cluster Formation in a Filamentary Cloud: The Case of the Stellar Cluster NGC 2316, The Astronomical Journal, 167:106 (18pp), DOI: 10.3847/1538-3881/ad19cd, Date of Publication: 13/02/2024, Impact Factor: 5

3. Saumya Gupta, Jessy Jose, Swagat R Das, Zhen Guo, Belinda Damian, Prem Prakash, Manash Samal, 2024, Search for brown dwarfs in IC 1396 with Subaru HSC: interpreting the impact of environmental factors on substellar population , Monthly Notices of the Royal Astronomical Society, Date of Publication: 05/02/2024, Impact Factor: 5

Atomic Molecular and Optical Physics Division [2]

1. Vanitha Patnala, Gangi Reddy Salla, Shashi Prabhakar, R. P. Singh, and Venkateswarlu Annapureddy, 2024, Analysing the Grain size and asymmetry of the particle distribution using auto-correlation technique, Applied Physics A, Date of Publication: 21/02/2024, Impact Factor: 2

2. JYan-mei Yu and B. K. Sahoo, 2024, Energy-level-crossing study of forbidden transitions in highly charged ions with (n=4,5)d6 and (n=4,5)d8 configurations for making optical clocks, Phys. Rev. A 109, 023106 (2024); https://doi.org/10.1103/PhysRevA.109.023106, Date of Publication: 05/02/2024, Impact Factor: 3

Geosciences Division [1]

1. Verma, P. K, Devaprasad, M., Dave. J, Meena. R, Bhowmik, H, Tripathi. S. N, and Rastogi, N., 2024, Summertime oxidative potential of atmospheric PM2.5 over New Delhi: Effect of aerosol ageing, Science of The Total Environment, 920, 170984, Date of Publication: 19/02/2024, Impact Factor: 10

Planetary Sciences Division [2]

1. Debabrata Banerjee, 2024, Theoretical modelling of alpha particle-induced X-ray signals from the lunar surface, Current Science, Date of Publication: 08/02/2024

2. Shiv Kumar Goyal, Amisha P. Naik, Piyush Sharma, Abhishek J. Verma, Nupoor A. Chotaliya, Mansi M. Soni, 2024, Characterization of CeBr3 and NaI (Tl) based detector modules with readout using an array of Silicon Photomultiplier for the future space exploration programs, Advances in Space Research, Date of Publication: 01/02/2024, Impact Factor: 2

Space & Atmospheric Sciences Division [1]

1. Nidhi Tripathi, Imran A. Girach, Sobhan Kumar Kompalli, Vishnu Murari, Prabha R. Nair, S. Suresh Babu, Lokesh Kumar Sahu, 2024, Sources and Distribution of Light NMHCs in the Marine Boundary Layer of the Northern Indian Ocean During Winter: Implications to Aerosol Formation, Journal of Geophysical Research: Atmospheres, Date of Publication: 06/02/2024, Impact Factor: 5

Theoretical Physics Division [1]

1. Nicolás Bernal, Partha Konar, Sudipta Show, 2024, Unitarity bound on dark matter in low-temperature reheating scenarios, Phys. Rev. D 109, 035018, Date of Publication: 23/02/2024, Impact Factor: 5.41

Udaipur Solar Observatory [3]

1. S. S. Rao, Nandita Srivastava, Monti Chakraborty, Sandeep Kumar, D. Chakrabarty, 2024, Observations of Geomagnetic Crochet at High-Latitudes Due To X1.5 Class Solar Flare on 3 July 2021, Space Weather, Date of Publication: 23/02/2024, Impact Factor: 4.0

2. Samriddhi Sankar Maity, Ranadeep Sarkar, Piyali Chatterjee, and Nandita Srivastava, 2024, Changes in Photospheric Lorentz Force in Eruptive and Confined Solar Flares, The Astrophysical Journal, Date of Publication: 08/02/2024, Impact Factor: 4

3. Satyam Agarwal, Ramit Bhattacharyya, Shangbin Yang, 2024, Study of Reconnection Dynamics and Plasma Relaxation in MHD Simulation of a Solar Flare, Solar Physics, Date of Publication: 05/02/2024, Impact Factor: 2

Awards & Honours

(1) **Dr. R. D. Deshpande**, Senior Professor Geosciences Division and Registrar, PRL has been **nominated as a member of the Senate of National Institute of Design (NID), Ahmedabad for a duration of two years.**

(2) **Mr. Anirban Ghosh**, Sr. Scientific Assistant, Atomic, Molecular and Optical Physics Division of PRL has received **The Best Poster Award** in the **"32nd DAE-BRNS National Laser Symposium (NLS-325)"** organised in collaboration with Indian Laser Association (ILA), held at RRCAT-Indore during 29 Jan - 01 Feb 2024.

(3) **Mr. Sandeep Singh**, PDF, Atomic, Molecular and Optical Physics Division of PRL has received **The Best Thesis Award** in the **"32nd DAE-BRNS National Laser Symposium (NLS-325)"** organised in collaboration with Indian Laser Association (ILA), held at RRCAT-Indore during 29 Jan - 01 Feb 2024.

(4) **Ms. Chahat Kaushik**, SRF, Atomic, Molecular and Optical Physics Division of PRL has received **The Best Poster Award** in the **"32nd DAE-BRNS National Laser Symposium (NLS-325)"** organised in collaboration with Indian Laser Association (ILA), held at RRCAT-Indore during 29 Jan - 01 Feb 2024.

(5) **The ProtoPol Team led by Dr. Mudit Srivastava**, Astronomy and Astrophysics Division of PRL has received **The Best Poster Award in Facilities, Technologies and Data Science category** in the **"42nd Meeting of the Astronomical Society of India (ASI 2024)"** jointly hosted by IISc, ISRO and JNP during 31 Jan - 04 Feb 2024.

(6) **Dr. Namita Uppal**, PDF, Atronomy and Astrophysics Division of PRL has received **The Best Poster Award** in Stars, Interstellar Medium, and Astrochemistry in Milky Way category in the **"42nd Meeting of the Astronomical Society of India (ASI 2024)"** jointly hosted by IISc, ISRO and JNP during 31 Jan - 04 Feb 2024.

(7) **Mr. Trinesh Sana**, SRF, Planetary Sciences Division of PRL has received **The 2024 LPI Career Development Award** participate in **"The 55th Lunar Planetary Science Conference (LPSC)"**, scheduled to held in The Woodlands, Texas during 11-15 March 2024.

VISITORS

1. **Prof. Michel Mayor, Nobel Laureate and Professor Emeritus at the University of Geneva, Switzerland** visited PRL to participate in the **International Conference on Planets, Habitability and Exoplanets (ICPEH)** held from 05–09 February, and he also delivered a public lecture titled "**Other Worlds in the Cosmos? The search for planets similar to Earth and ... perhaps harbouring life!**" as part of the proceedings.

2. **Prof. Bhanu Pratap Das, Director of the Centre for Quantum Engineering Research and Education, TCG Centers for Research Education in Science and Technology, Kolkata** visited PRL to deliver **PRL Colloquium 24-01** titled "**Quantum Computing: Applications in Atomic Physics**" on 15 February.

3. **Mr. Maslinskas Valdas from M/s Light Conversion, Keramiku 2B, Vilnius, Lithuania** visited PRL, Ahmedabad from 15–17 February in connection with **discussion on scientific equipment and site inspection for installation of Ordered equipment**.

4. **Prof. Christian Wohler of Technische Universitat Dortmund, Germany** visited PRL, Ahmedabad and Infra-Red Observatory, Mt. Abu for the period from 19–26 February in connection with C**ollaborative work on polarimetric observations using the Infra-Red Observatory, Mt. Abu**.

5. **Prof. Martin Paetzold of Rheinisches Institut Fur Umweltforschung, Cologne** visited PRL, Ahmedabad from 19–08 February in connection with **Personnel exchange programme under DST-DAAD Project as part of bilateral research promotion between India and Germany**.

6. **69 Students** part of the **STI R&D** Camp organized by the **Gujarat Council on Science and Technology (GUJCOST)**, visited both campuses of PRL on 19 February and **interacted with scientists**.

7. **Dr. Frank Presseur, Professor at the Institute of Earth and Environmental Sciences, University of Freiburg, Germany** visited PRL on 21 February to deliver the **89th PRL ka Amrut Vyakhyaan** titled "**Seven decades of using luminescence in geochronology**"

8. **Dr. M.S. Nanda Kumar of Centre de Astrofisica da Universidade do Porto (CAUP), Portugal** visited PRL, Ahmedabad from 28 February to 2 March in connection with **Scientific discussion and Research Scholars in the field of Star Formation**.

OBITUARY

Late Dr. Bimla Buti
Senior Professor-II

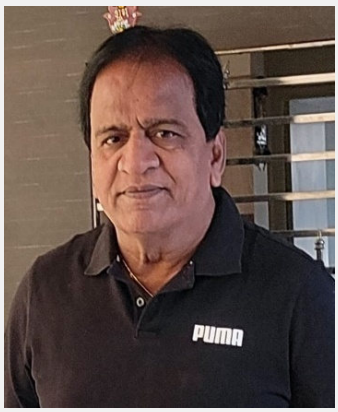
Date of Birth 19.09.1933

Date of Joining PRL 18.12.1967

Date of Death 24.02.2024

Teary Eyes for our Departed Member

SUPERANNUATION



Name of the employee	Shri Dipak J. Panchal
Designation at the time of superannuation	Senior Assistant
Date of Birth	16.02.1964
Date of Joining PRL	16.04.1992
Date of Superannuation	29.02.2024

Good Luck for your future endeavours

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