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# The Fourth State

Newsletter of the Institute For Plasma Research, Gandhinagar, Gujarat (India)



## नराकास, गांधीनगर के सौजन्य से आयोजित हिंदी व्याख्यान

नराकास, गांधीनगर के सौजन्य से प्लाज्मा अनुसंधान संस्थान द्वारा दिनांक 2 नवंबर 2023 को नराकास, गांधीनगर के सदस्य कार्यालयों के लिए एक हिंदी व्याख्यान का आयोजन किया गया। संस्थान के वैज्ञानिक अधिकारी डॉ. नीरव जमनापरा ने “आम जीवन में प्लाज्मा का महत्व” विषय पर व्याख्यान दिया। कार्यक्रम के प्रारंभ में श्री राज सिंह, सह अध्यक्ष, राभाकास ने सभी आगंतुकों का स्वागत किया एवं आईपीआर का संक्षिप्त परिचय दिया। इसके बाद डॉ. जमनापरा ने पदार्थ की चतुर्थ अवस्था “प्लाज्मा” का परिचय देते हुए प्लाज्मा के विविध रूप एवं विभिन्न क्षेत्रों में इसकी उपयोगिता पर विस्तार से प्रकाश डाला एवं श्रोताओं के संदेहों को दूर किया। नराकास, गांधीनगर के सदस्य कार्यालयों में फ्रंटियर मुख्यालय सीमा सुरक्षा बल, गांधीनगर, जनगणना कार्य निदेशालय गुजरात, सॉफ्टवेयर टेक्नोलॉजी पार्क्स ऑफ इंडिया, गांधीनगर, राष्ट्रीय सूचना-विज्ञान केन्द्र, गुजरात दमन व दीव भू-स्थानिक ऑकड़ा केन्द्र, केंद्रीय जल आयोग, गांधीनगर, निफ्ट गांधीनगर, न्यू इंडिया, होटल प्रबंधन संस्थान अहमदाबाद, भारतीय स्टेट बैंक प्रशासनिक कार्यालय, गांधीनगर, केन्द्रीय लोक निर्माण विभाग, गांधीनगर, बड़ौदा एपेक्स अकादमी, गांधीनगर एवं प्लाज्मा अनुसंधान संस्थान के कार्मिकों ने इस व्याख्यान में भाग लिया। व्याख्यान के पश्चात् नराकास, गांधीनगर के सदस्य कार्यालयों से आए कार्मिकों को आदित्य-अपग्रेड एवं एसएसटी-1 प्रयोगशाला का दौरा करवाया गया। प्रयोगशाला में श्री नितिन बैरागी, वैज्ञानिक अधिकारी-ई ने आगंतुकों को सरल हिंदी भाषा में एसएसटी-1 की जानकारी दी। सुश्री हर्षिता राज, वैज्ञानिक अधिकारी-डी ने आगंतुकों को आदित्य-अपग्रेड के बारे में जानकारी प्रदान की।



व्याख्यान देते हुए डॉ. नीरव जमनापरा



(L) प्रयोगशाला में आगंतुकों को एसएसटी-1 टोकामैक की जानकारी देते हुए श्री नितिन बैरागी (R) आगंतुकों को आदित्य अपग्रेड टोकामैक की जानकारी देते हुए सुश्री हर्षिता राज



LIGO-India Vacuum Integrated System Test Assembly (LI-VISTA) facility is currently being setup at LIGO-Lab in IPR for evaluation of 80K Cryopump efficacy in trapping water molecules moving along the length of assembly. It consists of two systems – (1) a 20 m long cylindrical vacuum vessel (IVV); (2) 1:1 scale 80K Cryopump (80K-CP) of LIGO. LIGO Division of IPR has successfully executed site installation of vacuum vessel. The IVV contract comprised of fabrication of vacuum vessel, integration with vacuum equipment, operation and installation of controls, integration of 50-inch large size gate valve, demonstration of ultra-high vacuum (UHV), supply and installation at IPR. The vacuum vessel cross-section closely resemble with the real beam tube of LIGO. The motivation of this procurement included assessment of fabrication feasibility of large diameter cylindrical vessel using combination of conventional circumferential seam and longitudinal seam welding. This fabrication technique is different than that used in LIGO beam tube fabrication which is spiral welding technique.

As a part of contract execution, two cylindrical vacuum vessels (1.24 m ID X 10 m long) have been fabricated. Efforts have been put together to establish procedure to perform welding in single pass while ensuring minimal heat affected zone and distortion at the weld joint. SS 304L sheets of 3.2 mm thickness is used in vessel construction which is similar to that of LIGO beam tube's wall thickness. The volume of the IVV will be maintained at an ultra-high vacuum (UHV) of  $< 1 \times 10^{-9}$  mbar during operation. To achieve this vacuum, a combination of roughing pump, turbo molecular pumps (TMP) and ion pumps are integrated with the vessel. Operation of all vacuum equipment is controlled through central control unit capable of remote operation. The IVV of 20m was fabricated in two sections of 10m each. The two numbers of 10-m sections were integrated using a bellow of equal cross-section in the middle. Each 10m vessel is made up of 7 individual shells by rolling 3.2mm thick X 1550mm wide sheet. Some of the fabrication challenges addressed during fabrication of these 10 m vessel sections include; (a) Qualification of welding process to perform single pass welding without any defects (b) Development of fixtures to perform vessel fabrication within required geometrical tolerance (c) Development of tools for handling long vessel during its lifting and its transportation.

Following functional requirements have been fulfilled to qualify for UHV compatibility during performance testing of the 20 m vessel assembly integrated with vacuum equipment (a) UHV compatible steam jet cleaning vacuum exposed surface of long length vessel (b) Axial as well angular alignment of 20 m vessel assembly (c) Precise baking of Vessel (up to 1500 C) using PID controlled Heating jackets (d) Individual Joint He leak tightness  $< 1 \times 10^{-10}$  mbar.l/s (e) Vacuum in the range of  $9.38 \times 10^{-8}$  mbar accomplished within 100 hours using TMP for pump-down.



(L) Testing of the Integrated Vacuum Vessel at the factory (R) The vacuum vessels transported to IPR by road from Mumbai



The vacuum vessels and the gate valve assembly being unloaded at IPR New Laboratory Building



The LI-VISTA vacuum vessels being assembled in the IPR New Laboratory Building



| Date      | Institution                           | Visitors                              |
|-----------|---------------------------------------|---------------------------------------|
| 11-Oct-23 | Ahmedabad University, Ahmedabad       | 12 students of BSc Physics            |
| 13-Oct-23 | Government Polytechnic, Palanpur      | 56 students of Diploma in engineering |
| 16-Oct-23 | Expert Group of Institutes, Mangalore | 17 students of class 12 (Science)     |
| 17-Oct-23 | Maharaja Agrasen Vidyalaya, Ahmedabad | 68 students of class 11-12 (Science)  |
| 25-Oct-23 | Ahmedabad University, Ahmedabad       | 30 students of science communication  |



Students of Expert Group of Institutes, Mangalore, during their visit to IPR



Students of Maharaja Agrasen Vidyalaya, Ahmedabad, during their visit to IPR



Students of Ahmedabad University, Ahmedabad, during their visit to IPR



IPR observed the “Vigilance Awareness Week -2023” during 30 Oct - 5 Nov, 2023. As part of the event, a series of talks related to vigilance from senior personnel from IPR Administration, Accounts, Purchase and Stores were arranged. Also, talks/seminars by external subject experts on Cyber Security, CCS rules, functions of CVC, CVO and IO/PO etc were also arranged for the benefit of IPR staff members. Various competitive events were also organized at IPR to bring about awareness regarding Vigilance. A *Nukkad Natak* was also enacted by IPR staff on the last day of the week, which was well received by the audience.



(L) A talk on Cyber Security by Shri Jigar Raval, Head, CNIT Division & Information Security Officer, Physical Research Laboratory, Ahmedabad (M) A seminar on Ethics and Governance by Shri Uday Sankar Chattopadhyay (faculty of ISTM, DOPT, GOI) (R) A seminar by Shri Uday Sankar Chattopadhyay on Functions of CVC, CVO and roles of IO/PO



(L) IPR staff at the vigilance lectures (R) Vigilance quiz in progress



“Nukkad Natak” being enacted during the Vigilance Week at IPR



Institute for Plasma Research (IPR), Gandhinagar (Gujarat), in association with the Vivekananda College of Arts, Science & Commerce, Puttur, Karnataka, organized an exhibition on Plasma, the fourth state of matter during 30-August to 1 September, 2023. This program is part of IPR's rural scientific outreach activity in the state of Karnataka. The programme consisted of an exhibition on plasma, its applications, introductory talks on plasma for visiting students as well as a training program for science teachers on plasma and its applications and nuclear fusion.

The event was inaugurated by Prof. C. H. Ishwara Chandra, Dean, GMRT Observatory, (TIFR), Pune. Dr. K. P. Bhat, President Vivekananda Vidyavardhaka Sangha, Puttur, presided over the function.

For this exhibition, 50 science students from BSc Physics and engineering of Vivekananda college were trained by IPR team to explain the exhibits to visiting students in their local language. Over 4000 students and general public visited the exhibition at Vivekananda College. Details of the event are [HERE](#).



The Plasma Exhibition at Vivekananda College of Arts, Science & Commerce, Puttur, Karnataka



Inauguration of the event



Prof. C. H. Ishwara Chandra and Dr. K. P. Bhat visiting the exhibition



## Plasma Exhibition @ Puttur (Karnataka)

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Students from schools of Puttur waiting to see the exhibition



(L) Training program for teachers (R ) Training the student volunteers



Student volunteers explaining the exhibits at the Plasma exhibition





CPP-IPR staff members taking Integrity Pledge on the observance of Vigilance Awareness Week (VAW) on 30-Oct, 2023.



CPP-IPR staff members taking pledge on the observance of Rashtriya Ekta Diwas on 31-Oct, 2023.

## Conference Presentations



**Dr. Mukesh Ranjan** gave an talk at the 13th Asian-European International Conference on Plasma Surface Engineering (AEPSE-2023) at Busan, South Korea during 5-8 Nov, 2023. He also presented a talk at the 7th International Conference on Nanostructuring by Ion Beams (ICNIB-2023) at UPES University, Dehradun during 2-4 Nov, 2023.



**Mr. Ram Krushna Mohanta**, a DDFS-Ph.D. research scholar, presented a talk on the "Effect of chamber pressure on the output properties of a DC plasma spray torch for VLPPS application" at the 12<sup>th</sup> edition of Asian Thermal Spray Conference (ATSC) held at IIT Madras from 2-4 Nov 2023. The talk was awarded the *Best Paper Award* at the ATSC 2023.



- ♦ **Talks presented at 29th IAEA Fusion Energy Conference, United Kingdom, 16-21 October 2023**
  - **Dr. Mayur Kakati**, gave a talk on "Studies on the retarded recrystallization of tungsten in CIRCLE-PSI exposed under extreme target temperature and long He<sup>+</sup>-fluence"
  - **Mr. Rohit Kumar**, gave a talk on "Preliminary divertor plasma operation in ADITYA-U tokamak"
  - **Ms. Arzoo Malwal**, gave a talk on "Simulations of inboard limited Scrape-Off Layer plasma operations in Aditya-Upgrade tokamak"
  - **Mr. Amit Kumar Singh**, gave a talk on "Trapped Electron Coupled ITG Turbulence Simulation for ADITYA - U"
- ♦ **Talks presented at Workshop on Calibration of ITER X-ray & VUV Diagnostics, ITER, Saint Paul les Durance, France, 23-24 October 2023**
  - **Dr. Santosh P Pandya**, gave a talk on "Calibration strategies for the ITER Hard X-ray Monitor"
  - **Ms. Sapna Mishra**, gave an invited talk on "Calibration Strategy for ITER XRCS-Survey"
- ♦ **Ms. Kajal Shah**, Pandit Deendayal Energy University, Gandhinagar, gave a talk on "Plasma Rotation and Impurity Transport Studies in the Aditya-U Tokamak Using Spectroscopic Techniques" on 26th October, 2023
- ♦ **Mrs. Anshika Chugh**, gave a talk on "Ratchet effects and Collective dynamics in passive and active systems" on 27th October 2023
- ♦ **Dr. Poonam Chauhan**, Indian Institute of Technology, Dhanbad, gave a talk on "Development of water-repellent coatings for cellulosic and metallic surfaces" on 27th October 2023
- ♦ **Dr. Daniel Raju**, gave a talk on "FEC-2023 highlights and the takeaway messages" on 2nd November 2023
- ♦ **Dr. Kaushal Purohit**, SVNIT Surat, gave a talk on "Eigensolution of the various potentials and its application in different fields" on 3rd November 2023
- ♦ **Mr. Uday Sankar Chattopadhyay**, Deputy Secretary (Retd 2020) & Faculty in ISTM, DoPT, GOI, gave a talk on "Ethics" on 3rd November 2023
- ♦ **Shri K N Vyas**, Homi Bhabha Chair, DAE, and Former Chairman AEC & Secretary DAE, gave a talk on "Relevance of Nuclear Power and SMRs for 'Net Zero' by 2070" on 7th November 2023
- ♦ **Prof. Avinash Khare**, Sikkim University, Gangtok, Sikkim, gave a talk on "Tunneling in dusty plasma, quantum mechanics and high jump" on 7th November 2023 (**Colloquium #327**)
- ♦ **Mr. Surjit Singh**, Former Director, Central Vigilance Commission, gave a talk on "An Overview of CCS (conduct) Rules & CCS (CCA) Rules - Important Provisions" on 10th November 2023
- ♦ **Dr. Salim Hassan Siddiki**, Indian Institute of Technology (ISM), Dhanbad, gave a talk on "Multicomponent-Based Nanocomposites for Wide-Band, Thin, and Lightweight Microwave Absorbing Materials" on 10th November 2023
- ♦ **Ms. Yashshri Patil**, gave a talk on "Characteristics Of APPEL Device Long Magnetized Plasma Column Produced Using Hollow Cathode Plasma Source" at 7th Asia-Pacific Conference on Plasma Physics, Japan, 12-17 November 2023
- ♦ **Mr. Prince Kumar**, gave a talk on "Study on rotating dusty plasma equilibria and their excitations in strongly coupled quasi-localized regime" on 24th November 2023

## Upcoming Events

- ♦ 38th National Symposium on Plasma Science & Technology (PLASMA 2023), UPES Dehradun, 4-8 December 2023; <https://event.ipr.res.in/event/8/>
- ♦ 67th DAE Symposium on Nuclear Physics (SNP-2023), Indian Institute of Technology, Indore, 9-13 December 2023; <https://barc.gov.in/symposium/snp23.pdf>
- ♦ Materials in Nuclear Energy Systems, New Orleans, Louisiana, United States, 10-14 December 2023; <https://www.ans.org/meetings/mines2023/>
- ♦ DAE-BRNS National Workshop on "Atomistic Modeling of Molecules and Materials (AMMM-2023)", Anushaktinagar, Mumbai, 11-14 December 2023; <https://barc.gov.in/symposium/ammm-2023/index.pdf>
- ♦ 16th International Conference on Plasma Science and Applications (ICPSA 2023), University of Lucknow, 12-14 December 2023; <https://sites.google.com/view/icpsa2023/home>
- ♦ Indian Nuclear Society's International Conference (INSIC-2023) "Nuclear for Clean Energy Transition", DAE Convention Centre, Anushaktinagar, Mumbai, 12-15 December 2023; <https://www.insic2023.org/>
- ♦ ASME India AM 3D Aero 2023 Technical Conference, Ramaiah Institute of Technology, Bengaluru, 13 - 14 December 2023; <https://www.am3d.org.in/>
- ♦ 13th Asia Plasma and Fusion Association Conference (APFA 2023), Hanyang University, Republic of Korea, 13-15 December 2023; <http://apfa2023.org/>
- ♦ 67th DAE Solid State Physics Symposium, Gandhi Institute of Technology and Management (GITAM), Visakhapatnam, Andhra Pradesh, 20-24 December 2023; <https://barc.gov.in/symposium/ssps.pdf>
- ♦ International Conference on Atomic, Molecular, Material, Nano and Optical Physics with Applications (ICAMNOP 2023), Delhi Technological University, Delhi, 20-22 December 2023; <https://www.icamnop.in/>

## Adieu



On behalf of the IPR Newsletter, I extend my heartfelt wishes to **Ms. Chhaya Chavda** for a joyous, healthy, and fulfilling retired life. Chhaya has been an invaluable member of both the Newsletter and IPR Outreach teams since their inception, making significant contributions to both teams. Over the course of our 25+ years of acquaintance, Chhaya has consistently demonstrated her sincerity and dedication as an esteemed member of the NL and ORD teams. Within the Outreach Division, Chhaya held a pivotal role, assuming responsibility for the management of various events organized by ORD, particularly the outstation events. Her exceptional networking skills and expertise in event management have earned her a well-deserved reputation. On the occasion of her superannuation on 31-Dec-2023, I commend Chhaya for her remarkable commitment and over 30 years of dedicated service to IPR. Her contributions have greatly enriched our organization, and we are grateful for her exceptional work ethics and her amiable nature. We wish her all the best in this new chapter of her life. — A. V. Ravi Kumar



Tournaments of several indoor & outdoor games like Carrom (singles and doubles), Table Tennis (men & women, singles and doubles) Badminton (men & women, singles and doubles), Volleyball and Chess were organized over the last few months for IPR staff members.

| Game                         | Winners                                             | Runners Up                        |
|------------------------------|-----------------------------------------------------|-----------------------------------|
| Chess                        | Yogendra Singh                                      | Yash Pathak                       |
| Carrom Singles               | Trivesh Kant                                        | Nancy Verma                       |
| Carrom Doubles               | Prabal Biswas & Hitesh Patel                        | Piyush Raj & Ashoo Sharma         |
| Table Tennis Singles (Men)   | Saurabh Dwivedi                                     | Arvind Kumar                      |
| Table Tennis Singles (Women) | Arpita Vipat                                        | Anshika Chugh                     |
| Table Tennis Doubles         | Madeena Valli & Arvind Kumar                        | Vrushank Mehta & Rajamannar Swamy |
| Volleyball                   | Team-Z Plus Scholars<br>Captain - Kaushlender Singh | Team-MMC<br>Captain- Anoop Singh  |
| Badminton (Single) Women     | Geethika B. R.                                      | Savita                            |
| Badminton (Single) Men       | Suruj Jyoti Kalita                                  | Shivakant Jha                     |
| Badminton (Doubles)          | Shivakant Jha & Vinit Shukla                        | Pratik Patel & Siddharth Kumar    |



Chess : (L) Yash Pathak (Runner-up), (R) Yogendra Singh (Winner). Carrom : (L) Nancy Verma (Runner-up) (R) Trivesh Kant (Winner)



Carrom (Doubles) : Piyush Raj & Ashoo Sharma (Runner-up), Prabal Biswas & Hitesh Patel (Winner). Table Tennis : (L) Saurabh Dwivedi (Winner) (R) Arvind Kumar (Runner-up).





Volleyball : (L) Team MC (Runner-up) (R) Team Z Plus Scholars (Winner)



Badminton: Women : (L) Geethika B R (Winner) (R) Savita (Runner-up) Badminton Men : (L) Suruj Jyoti Kalita (Winner) (R) Shivakant Jha (Runner-up)



Badminton Doubles (Men) : (L) Shivakant Jha & Vinit Shukla (Winners) (M) Pratik Patel & Siddharth Kumar (Runners-up). (R) Volleyball finals in progress





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## Know Your Colleague



Mr Vaibhav Ranjan joined IPR through the TTP 2010 batch after completion of his BTech in Electrical & Electronics from College of Engineering Roorkee, Uttarakhand Technical University, Dehradun in year 2010. From year 2011-2013 he was involved in SST-1 Plasma Control Division activities. From 2013-2018, he was involved in upgradation of Aditya-U Tokamak, O&M of grounding system, installation, connection of bus bars and change over switch of the power supplies, installation, connection and termination of three pairs of diverter coils and capacitor bank power supplies, temperature sensors in TF, VF coils in ADITYA-U Tokamak, laying, connection and termination of 1.1Kv grade aluminium cables. Since 2018, he has been with the Power Supply Division, where his duties included operation & maintenance of switchgears (Distribution Transformers, Circuit Breakers, LT Panels,) as well as Telecommunication Network (SIP Trunk) in IPR and FCIPT campuses. He is also involved in development of high current switches & pulse power supplies for small experiments. Overhauling of switchgears, O&M of Session Initiation Protocol (SIP) trunk telephone network, development of high current switches, simulation & analysis of capacitor bank power supply for tokamaks, installation of capacitor bank power supply. He is an As-

sociate Member of Institution of Engineers, Chartered Engineer (AM163784-6) and did his MS (Engineering) from HBNI, in the year 2021.

## Plasma Exhibition @ Puttur



IPR team with the volunteers from Vivekananda College during the Plasma exhibition held at Puttur

## The IPR Newsletter Team

|                   |                    |                  |                |              |                  |           |
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