

Issue 114

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The Fourth State

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



IPR Newsletter wishes all the staff members of IPR, FCIPT, ITER-India and CPP-IPR, a very

HAPPY
New Year 2023

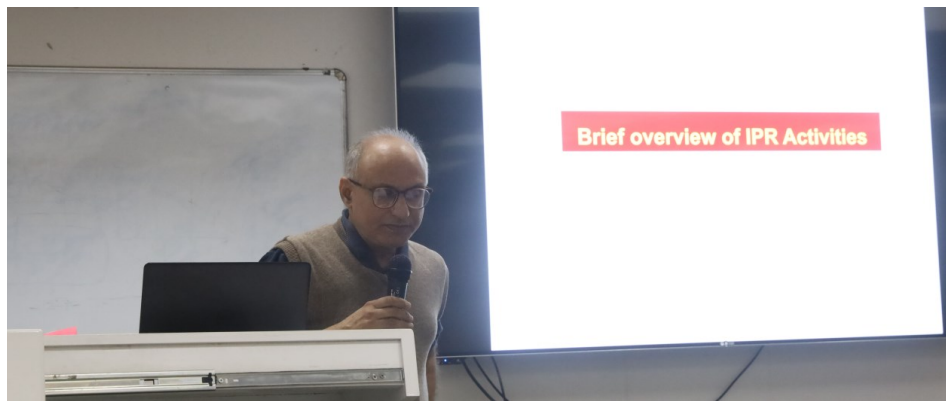
IPR Review - Round 2: Plasma & Fusion Technologies-II

IPR is organizing a review of its scientific/technical activities. The second step in this process was a review of Plasma & Fusion Technologies-II activities that was held at IPR during 28-29 November, 2022.

The eight-member committee consisting of Dr. Dinakar Kanjilal (Former Director, IUAC), Dr. Sujoy Bhattacharya (Former Director, Reactor Project Group, BARC), Dr. Bhanu Shankar Rao and Dr. T. Jayakumar (Both former Directors, Metallurgy and Materials Group, IGCAR), Shri P. K. Kush (Former Head, Cryo-Eng. & Cryo-Module Development Division, RRCAT), Prof M.D. Atrey (Professor, Department of Mech. Eng., IITB), Shri D.P. Yadav (Head, Ultra High Vacuum Technology Section, RRCAT) and Shri K. Jayarajan (Former Chairman, BARC Safety Council) reviewed the work undertaken by various divisions of IPR carrying out work in the areas of Plasma & Fusion Based Technologies.

While Dr. Subroto Mukherjee outlined the review process, Dr. Shashank Chaturvedi introduced IPR's activities to the committee. On 29th Nov, the committee visited various laboratories involved in the work that was reviewed on 28th Dec. They visited the Neutronics Lab, Remote Handling & Robotics Technology lab, Pellet Injection and Cryopump lab, High Heat Flux Test Facility, Fusion Fuel Cycle laboratory, Experimental Helium Cooling Loop (EHCL) facility and the Liquid Metal Labs & Hydrogen Isotope Extraction System Lab as part of the review process.

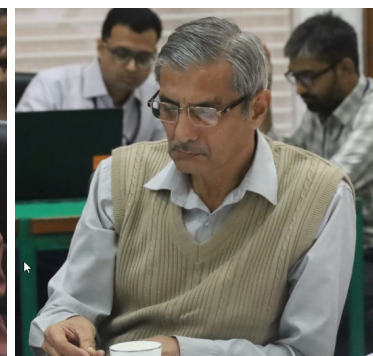
Fusion Reactor Blanket	Dr. Paritosh Chaudhuri Dr. Rajendra Bhattacharya Mr. Sudhir Rai	LIGO India activities at IPR	Mr. Vijay Bedakihale
		Remote Handling and Robotics	Mr. K. K. Gotewal Mr. Naveen Rastogi
		Fusion Neutron Sources and their applications	Mr. Sudhirsinh Vala
Diverter and High-temperature Technologies	Dr. Samir Khirwadkar Mr. Vinay Menon		
Pellet Injection and Cryo Pumps	Dr. Ranjana Gangradey		



(L) Dr. S Mukherjee outlining the review process and (R) Dr. Shashank Chaturvedi giving an overview of IPR activities



The review committee (L-R) Shri. D. P. Yadav, Shri K. Jayarajan, Prof. M. D. Atrey and Dr. T. Jayakumar



The review committee (L-R) Dr. D. Kanjilal, Dr. Bhanushankar Rao, Shri P.K. Kush and Dr. Sujoy Bhattacharya



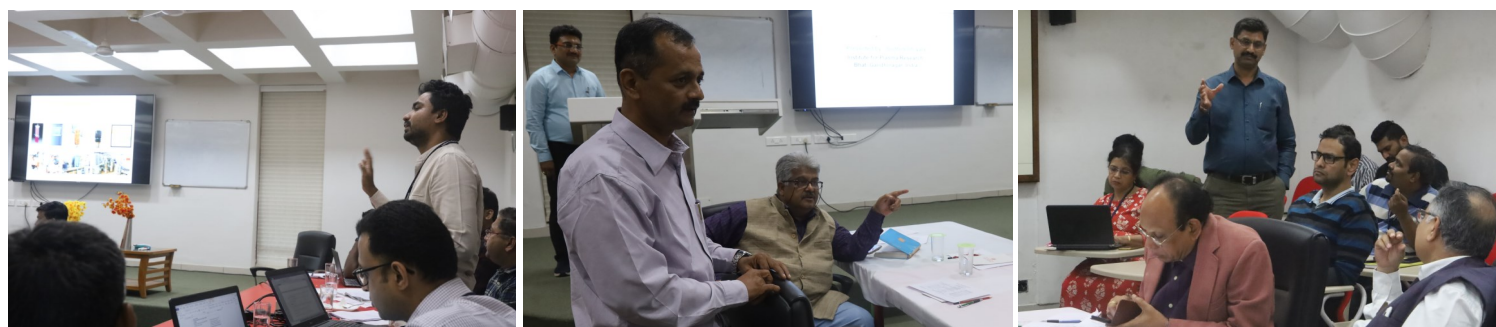
Group photo of the review committee and speakers



(L-R) Dr. Paritosh Choudhuri, Dr. Rajendra Bhattacharya, Mr. Sudhir Rai, Dr. Samir Khirwadkar and Mr. Vinay Menon



(L-R) Dr. Ranjana Gangradey, Mr. K. K. Gotewal, Mr. Naveen Rastogi, Mr. Vijay Bedakhale and Mr. Sudhirsinh Vala



The review meeting in progress



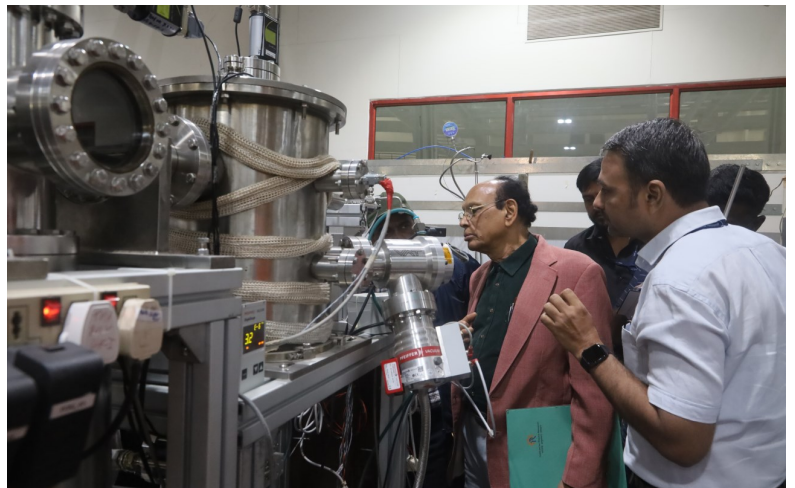
Committee members visiting the Neutronics laboratory



Committee members visiting the LIGO-India laboratory



Committee members visiting the RHRTD laboratory



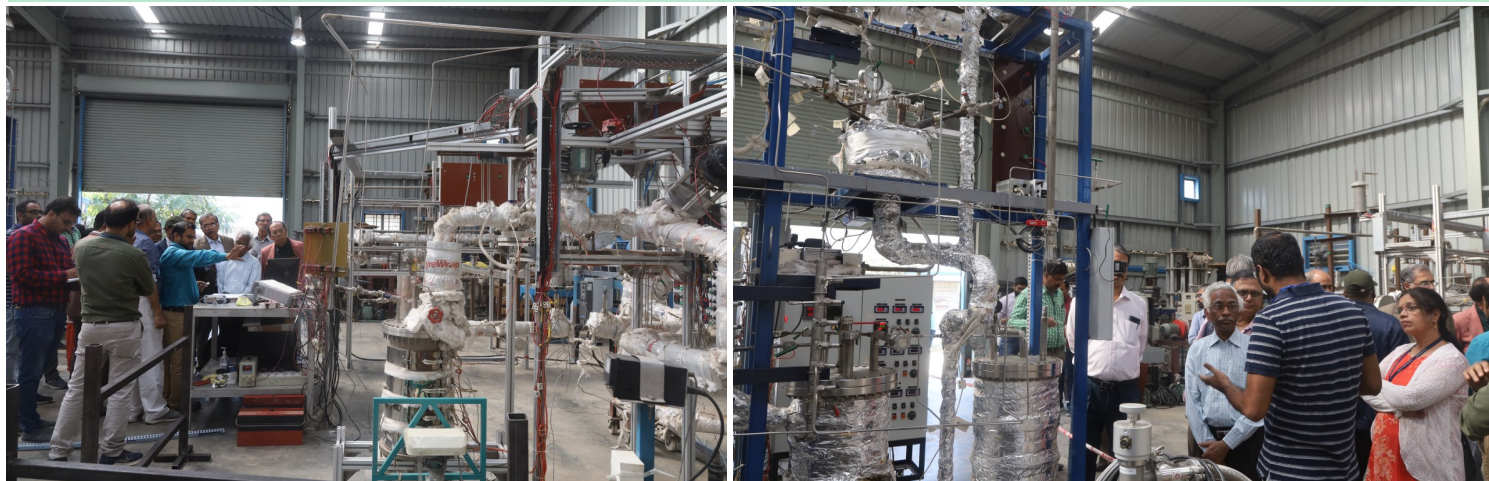
Committee members visiting the Cryopump laboratory



Committee members visiting the HHFTF laboratory



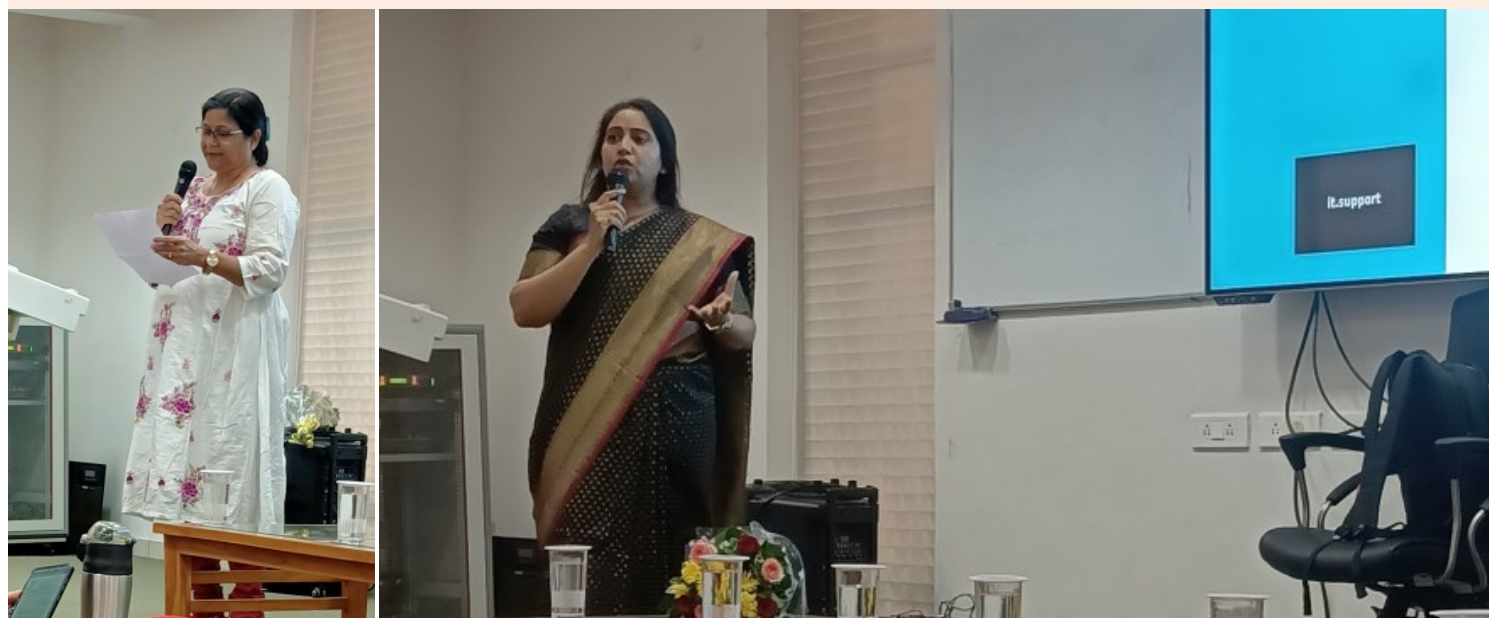
Committee members visiting the Fusion Fuel Cycle and EHCL facilities



Committee members visiting the Liquid Metal Labs & Hydrogen Isotope Extraction System Lab

International Day for the Elimination of Violence Against Women

In connection with the subject "International Day for the Elimination of Violence Against Women", a talk was delivered by eminent lawyer Ms. Hemlata Verma on 9-Dec-2022. Ms. Verma is also an external expert in IPR's Complaint Committee against Sexual harassments at work place. This talk was attended by several women staff of IPR.



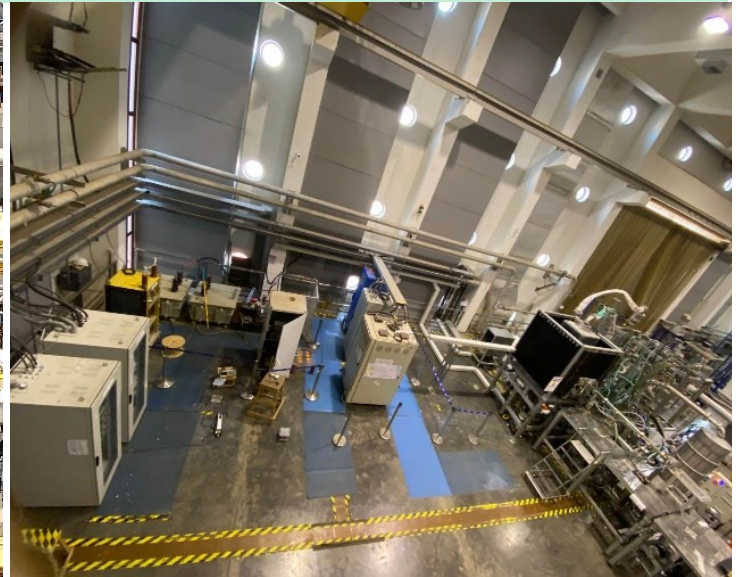
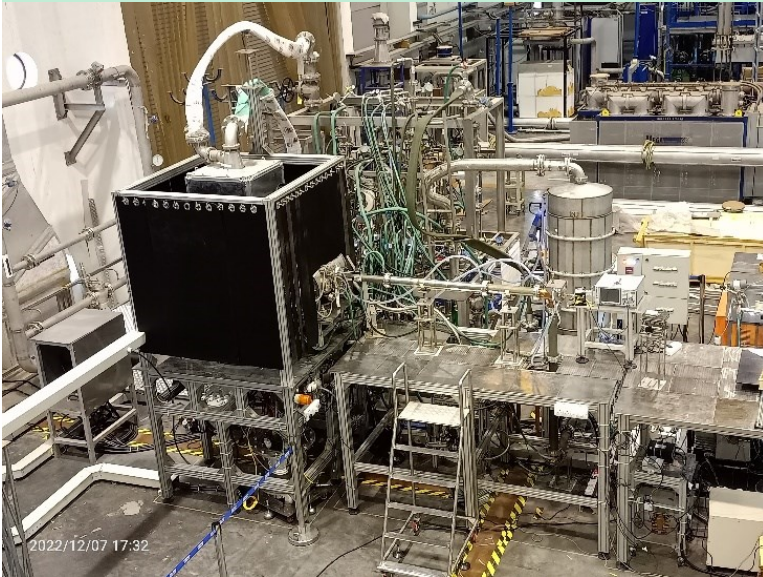
(L) Dr. Ranjana Gangradey introducing the speaker (R) Ms. Hemlata Verma delivering her lecture



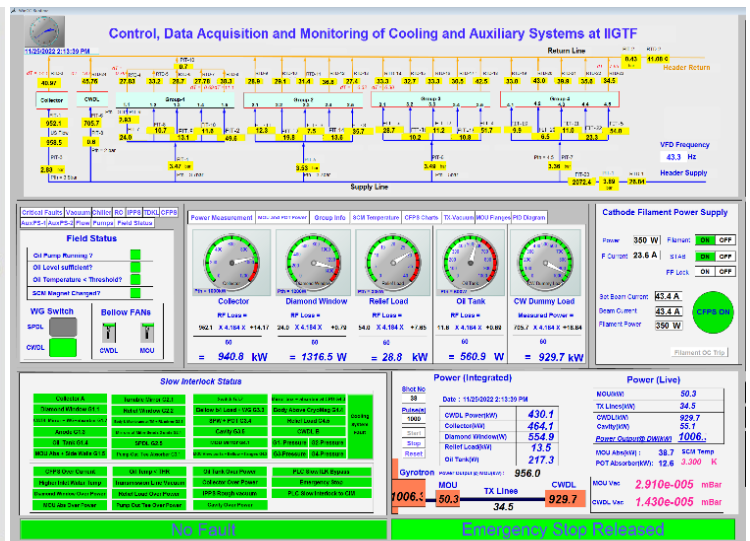
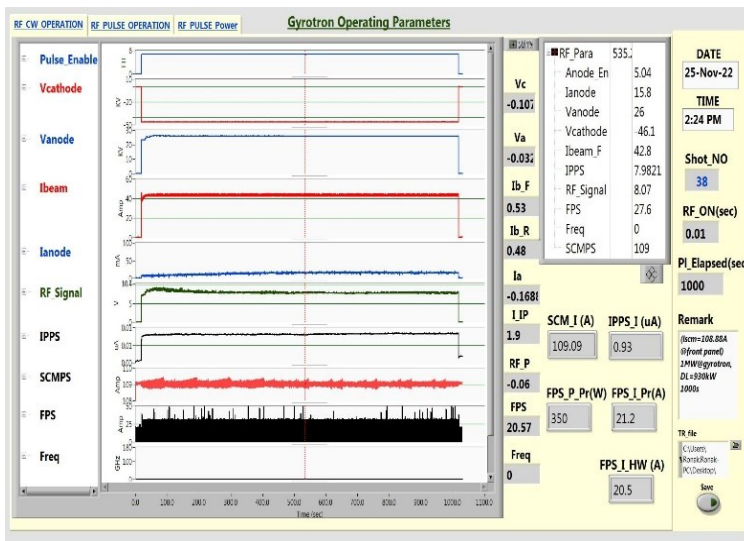
Successful Demonstration of 1MW RF Power at 170 GHz for 1000s

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One of the important developments at ITER-India during this year include successful completion of the site acceptance tests for a 170 GHz Gyrotron unit procured from Russia and integrated with the indigenously developed experimental test bed at ITER India lab in IPR. An average peak RF power of 1 MW at the output of the diamond window, across 5 successful pulses of 1000s duration, has been demonstrated. This is a significant achievement as far as the Indian scenario is concerned. The measured output frequency of the Gyrotron, is well within the specified range of 170 GHz $\pm$ 0.3 GHz. The RF efficiency estimated at the Gyrotron window output is found to be compliant with the specified value of 50%. More detailed tests such the reliability tests, modulation tests and some dependency tests etc. have also been carried out within the test facility limitations.



(L) Image of the Gyrotron Test setup at ITER-India Test Facility (R) Image of the Gyrotron Test facility overview



(L) Key Operating Parameters for 1 MW, 1000 s Pulse (R) Calorimetric Power Measurements for 1MW, 1000 s pulse





Images from the site acceptance tests (SAT)

As IPR Outreach initiative towards popularization of plasma, an exhibition on plasma, its applications and fusion was organized at IIT-Jodhpur in the sidelines of the “Plasma-2022” conference organized there during 12-14 December, 2022. The exhibition, which was organized at the Jodhpur club in the IIT campus, was inaugurated by Director IIT-Jodhpur, Prof. Santanu Chaudhury. Students from schools of Jodhpur as well as students, staff and family members of staff of IIT-Jodhpur attended the exhibition. The exhibition also had popular talks on plasma and its applications. Over 800 visitors visited the exhibition. This event was coordinated by Dr. Prabhat Jaiswal and Dr. Shahab Ahmad of the Dept. of Physics, IIT-J.



Inauguration of the exhibition by Director, IIT-Jodhpur



Student volunteers of IIT-J interacting with Prof Bimla Buti during her visit to the exhibition.



Student volunteers of IIT-J explaining the exhibits to visitors.



Popular talk on plasma for school students



Student volunteers of IIT-J explaining the exhibits to visitors.



A two-day seminar on “Plasma for Space and Aerospace Applications (PSAA-22)” was organized by IPR at FCIPT, IPR, during 24-25th November 2022. The objective of the seminar was to disseminate the information regarding the available expertise and infrastructure at IPR in the area of plasma-space technologies. Further, it was also aimed at providing a platform for the other experts in this field to present their capabilities, and for start-ups to discuss about the issues faced by them so that their solutions can be explored using plasma based technologies.

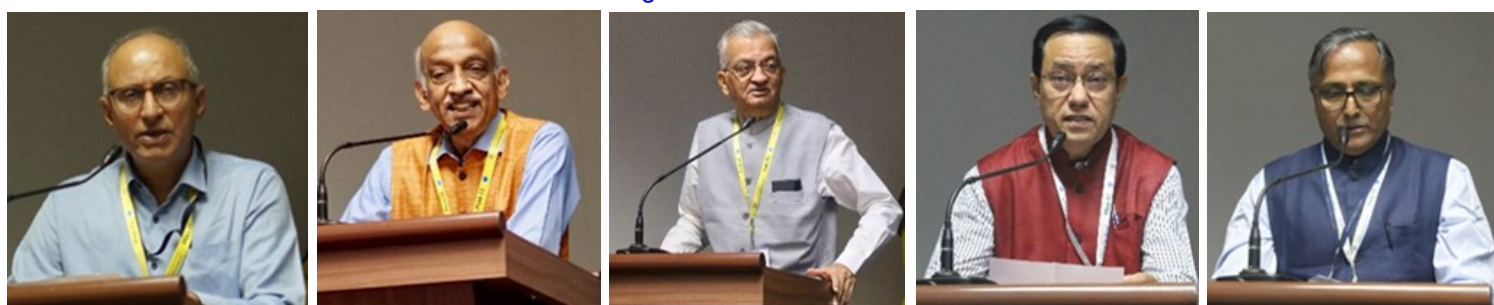
The inaugural session of the seminar was held in the presence of Chief Guest Dr. Anil Kakodkar (Chancellor, Homi Bhabha National Institute; Member, Atomic Energy Commission; Former Secretary, Department of Atomic Energy), Guest of Honour Shri A. S. Kiran Kumar (Former Secretary, Dept of Space, Vikram Sarabhai Professor ISRO; Member, Space Commission, Govt. of India), and Distinguished Guest Prof. P. I. John (founder of FCIPT; former Senior Professor, IPR), along with Dr. Shashank Chaturvedi (Director, IPR), Dr. P. K. Atrey (Chairman, LOC-PSAA-2022) and Dr. -Ing. Suryakant Gupta (Convener, PSAA-2022) inaugurated the seminar by lighting the traditional lamp and releasing the seminar Abstract Book. A welcome address was given by Dr. Shashank Chaturvedi, Director, IPR followed by addresses from the Chief Guest and the Guest of Honour. The subsequent technical sessions followed after the inaugural sessions with the keynote address by Dr. P. I. John.

The Seminar was attended by approximately 200 delegates (both in offline and online modes) from reputed institutes like various centres of ISRO viz. SAC, LPSC, IN-SPACE, URSC, NSIL etc. and private start-ups & industries like M/s Dhruva Space, M/s Bellatrix Aerospace etc. Experts from these institutes and industries have also delivered lectures. Presentations mainly covered broad areas like Plasma Thruster & associated Technologies, SPIX Test facilities, Plasma based surface engineering & coatings for space applications, Plasma diagnostics, Plasma based aerodynamic drag reduction studies, Simulation & CFD analysis, availability of high heat-flux test facility and neutron & ion irradiation facilities, reconfigurable plasma antenna and indigenous development of cryo pumps for space applications etc. Presentations also included unique topics like Business Opportunities in Space sector. Private start-ups like M/s Dhruva Space and M/s Bellatrix Aerospace have also contributed by presenting on interesting topics.

The seminar was concluded with a panel discussion anchored by Dr. Nirav Jamnapara, Head, Projects Technology Transfer Section, IPR. The panel lead by Prof. P. I. John comprised of subject experts from government institutes viz. SAC, LPSC, and from private industries like M/s Cenerge Engineering Solutions and M/s Bellatrix Aerospace. The Panel obtained feedback from participants about the seminar and also discussed about the potential possible collaboration areas.



Inauguration of PSAA-2022



(L-R) Dr. Shashank Chaturvedi, Shri A. S. Kiran Kumar (Guest of Honour), Dr. Anil Kakodkar (Chief Guest), Dr. P. K. Atrey (Chairman LOC-PSAA) and Dr. -Ing. Suryakant B. Gupta (Convener) addressing the gathering.



Releasing the Abstract Book of PSAA-2022



(L-R) Prof. P.I. John delivering the keynote address, Invited Talks delivered by Dr. Alphonsa Joseph (IPR), Mr. K. M. Shanbhogue, (LPSC, ISRO) Dr. Mukesh Ranjan (IPR), Dr. Vinod Kumar (IN-SPACE) and Ms. Krishna Priya Ganesan (URSC, ISRO).



(L-R) Invited Talks delivered by Dr. Jaimin Desai (SAC, ISRO), Dr. Samir S. Khirwadkar (IPR), Ms. Renu Bahl (IPR) Mr. Vishal (M/s Dhruva Space), Mr. Rajan Babu (IPR) and Mr. N. Rajesh (M/s Bellatrix Aerospace)



(L-R) Invited Talks delivered by Mr. A. Arunachalam (NSIL), Dr. Ranjana Gangradey (IPR), Mr. Sudhirsinh Vala (IPR), Dr. Ramkrishna Rane (IPR), Dr. Rajesh Kumar (IPR), Mr. K. T. Sandeep (IPR) and Panel Discussion moderated by Dr. Nirav Jamnapara (IPR)



Group photo of the delegates of PSAA-2022 at FCIPT



The participants of PSAA-22 visiting the various labs at FCIPT

- ◆ **Dr. Mainak bandyopadhyay** gave a talk on “Overview and summary of the 25th International Workshop on Electron Cyclotron Resonance Ion Sources 2022 (ECRIS2022)” at Institute for Plasma Research, Gandhinagar, 12-14 October 2022
- ◆ **Dr. Mrityunjay Kundu** gave a talk on “Energy distribution of laser coupled cluster electrons in an ambient magnetic field” at 6th Asia-Pacific Conference on Plasma Physics (AAPPS-DPP2022), online, 14th October 2022
- ◆ **Dr. Mrityunjay Kundu** gave a talk on “Two-stage acceleration of electrons by intense laser-cluster interaction in strong magnetic environment” at 64th Annual Meeting of the APS Division of Plasma Physics (Online), 18th October 2022
- ◆ **Mr. Sunil Bassi**, gave a talk on “Numerical Simulation of Diesel Combustion Passing through High Power Arc Region in a Plasma Fuel System” at 27th National Conference on IC Engines and Combustion (NCICEC2022) organised by VIT Vellore, 6th November 2022
- ◆ **Talks presented at 13th Biennial National Conference of Physics Academy of North East (PANE), Department of Physics, Manipur University, Imphal, Manipur, 8-10 November 2022**
 - **Dr. S. R. Mohanty**, gave a talk on “Study on radiations emitted from an inertial electrostatic confinement fusion device and their applications”
 - **Dr. S. R. Mohanty**, gave a talk on “Enhancement in neutron production rate via adaptation of different confinement mechanisms in a cylindrical inertial electrostatic confinement fusion device”
- ◆ **Dr. Mahesh Saini**, gave a talk on “Low energy ion-beam induced pattern formation on sputtered Al films for achieving manifold SERS enhancement” at 7th International Conference on Ion Beams in Materials Engineering and Characterization (IBMEC 2022) at Inter-University Accelerator Centre (IUAC), New Delhi, 16-19 November 2022
- ◆ **Dr. Prachi B. Orp**, gave a talk on “Studies on nanoparticles’ formation in liquid and gaseous media” on 17th November 2022
- ◆ **Dr. Mumtaz Ali Ansari**, gave a talk on “Design and Development of High Power RF Antennae for the Pre-ionization and RF-Assisted Wall Conditioning Experiments in SST-1 and Characterization of RF Plasma Discharge in Multi-Cusp Plasma Device” on 21st November 2022
- ◆ **Dr. Sejal Shah**, gave an invited talk on “ITER: A Step to Harness Safe and Clean Energy & Material Challenges under Radiation” at Energy Summit, 2022, University of Petroleum & Energy Studies, Dehradun, on 23th November 2022
- ◆ **Dr. Raj Jada**, University of Queensland, Australia, gave a talk on “Condition Evaluation of Transformer Insulation Using Polarisation Based Method” on 28th November 2022
- ◆ **Dr. Abhinav Jain**, Tel Aviv University, Israel, gave a talk on “Development of mock-up RF matching network for ICRH system of Tokamak and its optimization with continuously variable load” on 30th November 2022
- ◆ **Prof. Swadesh Mahajan**, Institute for Fusion Studies, The University of Texas at Austin and Adjunct Professor at the Shiv Nadar University, Delhi, gave a talk on “Why and How of Transport Barriers-Advancing Nuclear Fusion: An examination through dynamic constraints and basic notions of statistical mechanics” on 6th December 2022 (**Colloquium #318**)
- ◆ **Dr. Gaurav Saxena**, Delhi Technological University, New Delhi, gave a talk on “Design and Analysis of Microwave Components for Mimo Communication System” on 9th December 2022
- ◆ **Dr. Nilamani Sahoo**, IIT Ropar, Punjab, gave a talk on “Ferro and electrohydrodynamics of impacting droplets” on 16th December 2022
- ◆ **Dr. Sayantan Mukherjee**, gave a talk on “Investigations on nanofluids as working medium in domestic solar water heating systems” on 16th December 2022
- ◆ **Dr. Tejendra Patel**, gave a talk on “3D Computational Fluid Dynamics Analysis of PINI Ion Source Back Plate under high heat flux condition” on 21st December 2022

Upcoming Events

- ◆ NEA Nuclear Safety Research Joint Projects Week: A Success Story and Opportunities for Future Developments, (virtual), 9-13 January 2023; https://icgr2020.org/jcms/pl_72839/nea-nuclear-safety-research-joint-projects-week-a-success-story-and-opportunities-for-future-developments
- ◆ International Symposium on Zero-Carbon Energy Systems, Tokyo, Japan, 10-12 January 2023; <https://www.izes1.org/index.html>
- ◆ 23rd National Symposium on Radiation Physics (NSRP-23), University of Mysore, Mysuru, 19-21 January 2023; <https://www.nsrp23.org/>
- ◆ National Conference on Emerging Trends in Vacuum Electronic Devices & Applications (VEDA-2022), Bengaluru, 19-21 January 2023; <http://www.vedas.org.in/>
- ◆ European Winter Conference on Plasma Spectrochemistry, Slovenia, 29th January-3rd February 2023; <https://ewcps2023.si/>
- ◆ 43rd Workshop on High Energy Density Physics with Intense Ion and Laser Beams, Berlin, 29th January-3rd February 2023; <https://indico.gsi.de/event/15752/>

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Know Your Colleague



Mr. Avadhesh R. Maurya joined IPR in February 2009 as a Scientific Assistant-B and is currently working as a Scientific Assistant-D for the Basic Theory and Simulation Division (BTSD).

His contribution is in the installation of operating system and various scientific codes. He also manages and resolves the technical and software issues faced by the BTSD group.

He has also developed conference website Conference On Plasma Simulation (CPS-2020) which was organized by IPR in year 2020. Currently, he also manages the division website and its upgradation.

Plasma Exhibition at IIT-Jodhpur



The student volunteers from IIT-Jodhpur with IPR Outreach team during the Plasma Exhibition held at IIT Jodhpur

The IPR Newsletter Team

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