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The 4th State

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



प्लाज्मा अनुसंधान संस्थान
Institute for Plasma Research

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

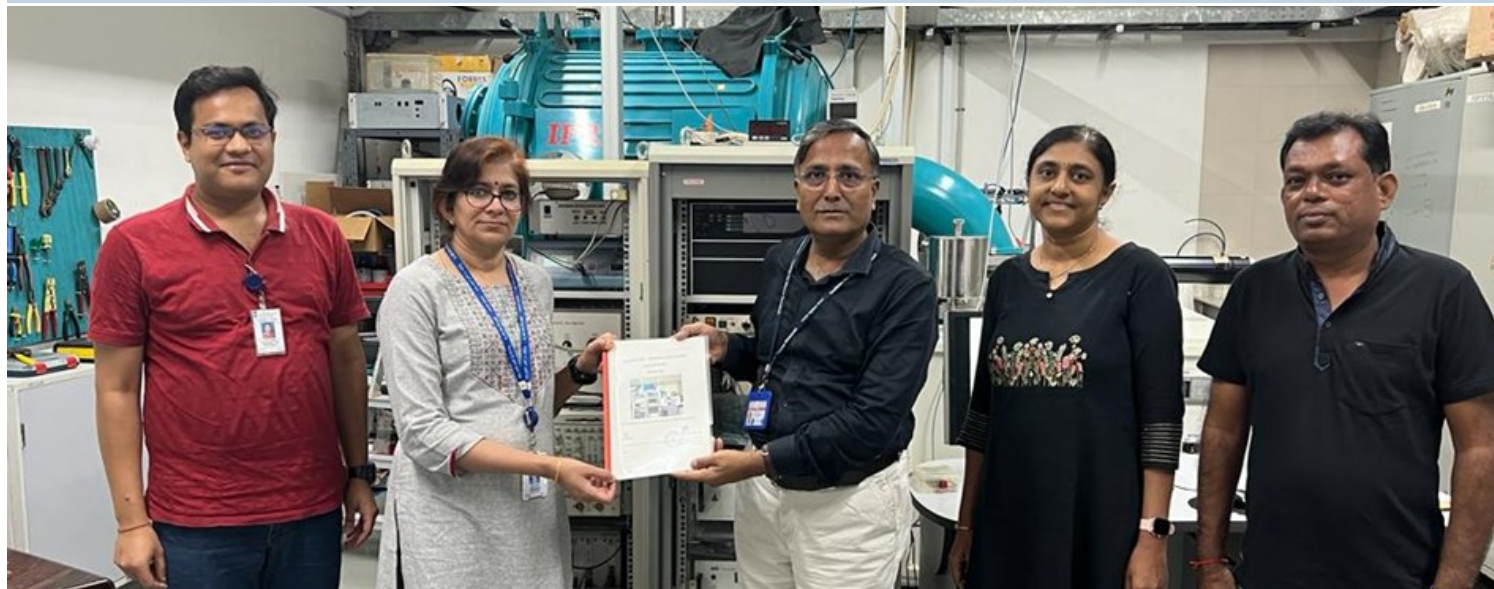
HAPPY New Year 2024

तकनीक के साथ, विज्ञान की बात

“तकनीक के साथ, विज्ञान की बात”, हिंदी वक्तव्य श्रृंखला के तहत 02 दिसंबर 2023 को आईपीआर के सेमिनार हॉल में एक हिंदी व्याख्यान आयोजित किया गया। इस अवसर पर डॉ. सुब्रतो मुखर्जी, वरिष्ठ प्रोफेसर-एच एवं डीन, प्रशासन ने “लीगो - गुरुत्वाकर्षण तरंग की खोज हेतु” विषय पर व्याख्यान दिया। इस वक्तव्य में डॉ. मुखर्जी ने चित्र एवं विडियो के माध्यम से लीगो पर विस्तार से चर्चा की। उन्होंने विश्व में व्याप्त लीगो-डिटेक्टर की जानकारी देते हुए आईपीआर में लीगो परियोजना पर किये जा रहे कार्य के अंतर्गत वैक्यूम चैम्बर के निर्माण पर चर्चा की। उन्होंने यह भी बताया की युवा वैज्ञानिकों के लिए इस क्षेत्र में अनुसंधान के नये अवसर उपलब्ध हैं। डॉ. मुखर्जी ने बहुत ही सरल हिंदी भाषा में इस तकनीकी विषय पर व्यापक जानकारी प्रदान की, जिससे आईपीआर में कुछ वर्षों पहले प्रारंभ हुई इस लीगो परियोजना से सभी श्रोताओं को परिचित होने का सुअवसर मिला। व्याख्यान के पश्चात लगातार एक घंटे तक प्रश्नों का दौर चलता रहा। डॉ. मुखर्जी ने बड़े ही धैर्य एवं सरलता के साथ श्रोताओं के प्रश्नों के उत्तर दिये। डॉ. विनय कुमार द्वारा डॉ. मुखर्जी को राजभाषा कार्यान्वयन समिति की ओर से स्मृति के रूप में एक भेट प्रदान की गई। अंत में श्री राज सिंह द्वारा धन्यवाद ज्ञापन के साथ इस कार्यक्रम का समापन हुआ।



हिंदी व्याख्यान की झलकियाँ



FCIPT, IPR has successfully completed two projects on “Spacecraft plasma interaction experiments” namely SPIX & SPIX-II in collaboration with URSC, Bangalore. Under these projects, an indigenous experimental test facility [SPIX-II] was developed to simulate LEO and GEO like space conditions in the laboratory. This facility meets the standards described in the ISO standards [ISO-11221] which is jointly prepared by NASA-USA, ESA-France, and JAXA-Japan. From the encouraging experimental findings of SPIX-II test facility, U.R. Rao Satellite Centre [URSC] approached IPR to upgrade existing SPIX-II to -III test facility that can meet the future challenges of satellite industry. SPIX-III test facility has been successfully upgraded and accepted by the URSC, ISRO team. This facility will be used to test and validate newly designed satellite solar panels developed by the U.R. Rao Satellite Centre ISRO Bengaluru.

Nobel Prize Day @ Gujarat Science City

Gujarat Council of Science City celebrated the Nobel Prize Day on December 10, 2023. Dr. Paritosh Chaudhuri and Ms Chhaya Chavda were invited to participate in this event and they addressed the gathering of high school students on the topics of Noble Prize as well as various outreach activities of IPR.



Images from the Nobel Prize Day @ Gujarat Science City

Academic Visits to IPR During November, 2023

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Date	Institution	Visitors
1-Nov-2023	Countryside School, Surat	62 students of 11 & 12 th std (science)
2-Nov-2023	SN Patel Institute, Bardoli	126 students of BE (CE)
7-Nov-2023	SGVP International School, Ahmedabad	29 students of 11 & 12 th std (science)
7-Nov-2023	Divyapath School, Ahmedabad	85 students of 9-11 Std
22-Nov-2023	Anand Vidyavihar, Vadodara	88 students of 11 & 12 th std (science)



Students and teachers of SGVP International School, Ahmedabad, during their visit to IPR



Students of Divyapath School, Ahmedabad, during their visit to IPR



Students and teachers of Countryside School, Surat, during their visit to IPR

Plasma Exhibition @ Kozhikode (Kerala)

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Institute for Plasma Research (IPR), Gandhinagar, in association with the National Institute of Technology (NIT) Calicut (Kerala), the District Institute of Education & Training (DIET), Kozhikode and the EduMission Kozhikode, organized "The 4th State : Plasma Exhibition" during 4-8 September, 2023 at NIT Calicut. This program, which is part of IPR's scientific outreach activity in the state of Kerala was organized as "CURICON-Plasma Exhibition and Innovation Fest" event for school and college students of the district of Kozhikode, Kerala. 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. M. K. Jayaraj, Vice-Chancellor, Calicut University. For this exhibition, engineering and physics students from NIT-C as well as science teachers from several schools in Kozhikode district were trained by IPR team to explain the exhibits to visiting students in their local language. Training programme for 25 science teachers from schools in Kozhikode district was also conducted during the event. Over 12,000 students and general public visited the exhibition at NIT-Calicut. Read more about it [HERE](#).



The Plasma Exhibition at NIT Calicut



Inauguration of the event



(L-R) Prof. M. K. Jayaraj (V-C, Calicut University); Prof. Prasad Krishna (Director, NIT-C); Dr. A V Ravi Kumar

Plasma Exhibition @ Puttur (Karnataka)

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Vice-Chancellor, Calicut University Prof. M. K. Jayaraj visiting the plasma exhibition



(L) Introducing plasma to visiting students (R & below) Students waiting to see the plasma exhibition



Student volunteers explaining the exhibits at the Plasma exhibition

The 3rd A. K. Sundaram Memorial Lecture was delivered by Professor Arnab Rai Choudhuri (Indian Institute of Science, Bengaluru) at IPR on 14th December, 2023. In his lecture, Prof Choudhuri talked about the 11-year sunspot cycle and the dynamo process in the sun-based prediction of the solar cycle which was carried out by Prof. Choudhuri and his group.

Prof. A. K. Sundaram was a past, distinguished faculty member and Dean of IPR. Watch the recording [HERE](#).



Images from the A K Sundaram Memorial Lecture held at IPR

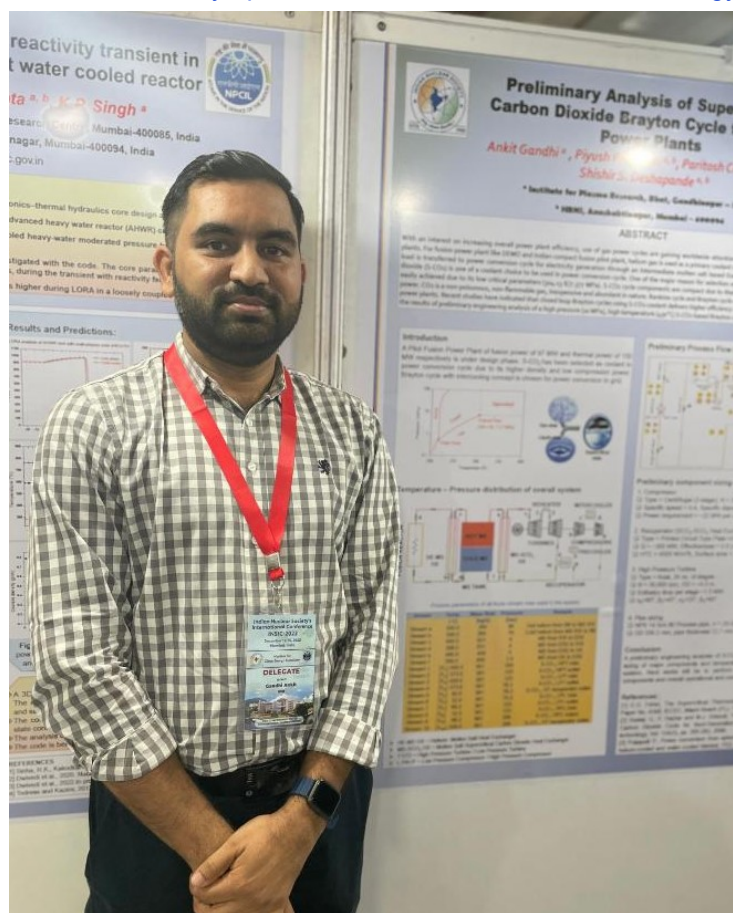
Awards 2023



Dr. Amreen Ara Hussain of FCIPT, IPR, was awarded the Parvez Guzdar Young Scientist Award 2023, for her work on "*Development of Hybrid Material Based Optoelectronic Devices using Plasma Technologies*". The award was presented to her during a special session of the Annual Conference of the Plasma Science Society of India (Plasma-2023) held at UPES Dehradun during December 4-8, 2023. The award contained a citation and a cash prize of Rs.10,000/-. This award was instituted in memory of Dr. Parvez Guzdar by the Parvez Guzdar memorial fund.



The winners of the Z. H. Sholapurwala Poster Award For Fusion Research-2023 (R-L) Santosh P. Pandya, Ashok Kumar Kumawat and Omkar Chandratre with Dr. N. Ramasubramanian, Secretary, PSSI. These awards were presented during the 38th National Symposium on Plasma Science & Technology (Plasma 2023) held at UPES, Dehradun during 4-8 Dec, 2023



Mr. Ankit Gandhi presented a poster entitled "Preliminary Analysis of Supercritical Carbon Dioxide Brayton Cycle for Fusion Power Plants" at Indian Nuclear Society's International Conference: Nuclear for Clean Energy Transition (INSIC-2023), DAE Convention Centre, Mumbai, 12-15 December 2023. He received the **Best Poster Award** for his poster.



Ms. Swarnima Singh, gave an invited talk on "Breaking the Hexagonal Lattice Barrier: Experimental Achievement of Square Lattice Formation in 2D Dusty Plasma Crystal", at the 7th Asia-Pacific Conference on Plasma Physics (AAPPS-DPP), Japan, 12-17 November 2023. She was also awarded the **2023 U30 Doctoral Scientist / Student Award** at this conference.

Ministry of Science & Technology, the Ministry of Earth Sciences, the Department of Space, and the Department of Atomic Energy, in association with *Vijnana Bharati* (VIBHA), is organizing the 9th India International Science Festival (IISF-2023) during 17-20 January 2024 at Faridabad, Haryana. As per the government directive, in connection with this, special outreach activities were organized at IPR main campus during 13-22 December, 2023. During this period, students of several schools visited IPR. During their visit, the students were given an introduction to plasma and its applications, given live demonstrations of plasma with over 25 exhibits and were also taken on a tour of the SST-1 tokamak at IPR. During this period, over 500 students and teachers of 10 schools and two colleges visited IPR.



Students and teachers of Sughad Primary School, Sughad, Gandhinagar, during their visit to IPR



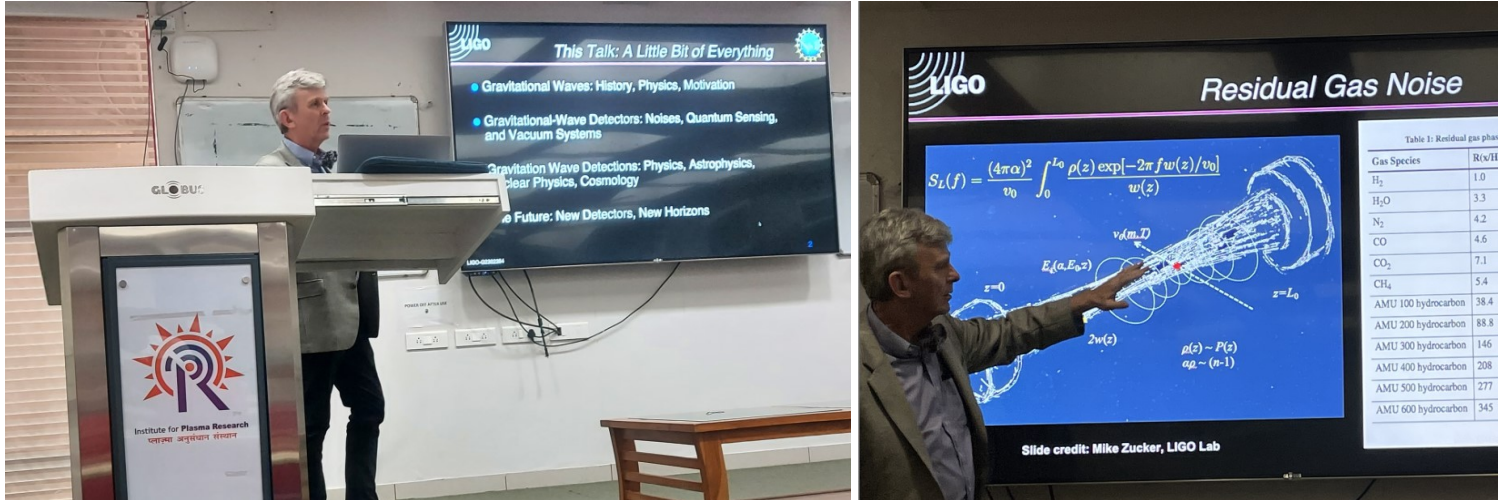
Students and teachers of Sheth N M Patel High School, Rancharda, Gandhinagar, during their visit to IPR



Visiting students interacting with the exhibits and IPR staff

Prof. David H. Reitze, Director, LIGO Laboratory and Dr. Brian O'Reilly, Lead Scientist, LIGO Laboratory visited IPR during 13-14, Dec 2023. During their visit, they visited the LIGO-Lab in the New R&D building to see newly installed LI-VISTA (LIGO-India – Vacuum Integrated System Test Assembly) facility where 20 m vacuum vessel and 80K Cryopump installation and testing work is in progress. This visit could demonstrate LIGO-USA team Indian industries capabilities to take up fabrication of LIGO-India vacuum system for main project. During discussions, the LIGO division updated them on other ongoing activities of LIGO-India project in which LIGO-Division, IPR is involved.

Dr. Brian O'Reilly also visited the LIGO-India Project site at Hingoli, Maharashtra along with Mr. Hitesh Gulati, Mr. Vijay Bedakihale and other members from DCSEM and IUCAA to see and assess the LIGO-India site work in progress. Prof. David H. Reitze gave a colloquium on “Gravitational-wave Astrophysics with the LIGO-Virgo-KAGRA Network: Where Have We Been, Where Are We, Where Are Going?” on 13th Dec, 2023 at IPR.



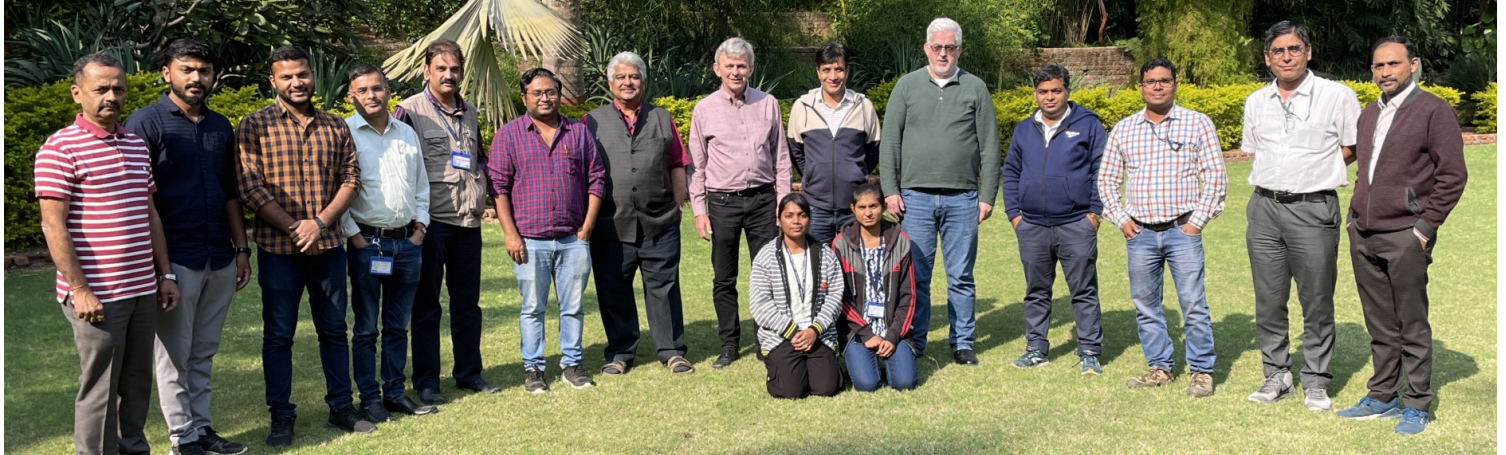
Prof. David H. Reitze delivering the lecture on gravitational waves at IPR



Prof. David H. Reitze and Dr. Brian O'Reilly visiting the LI-VISTA facility at IPR



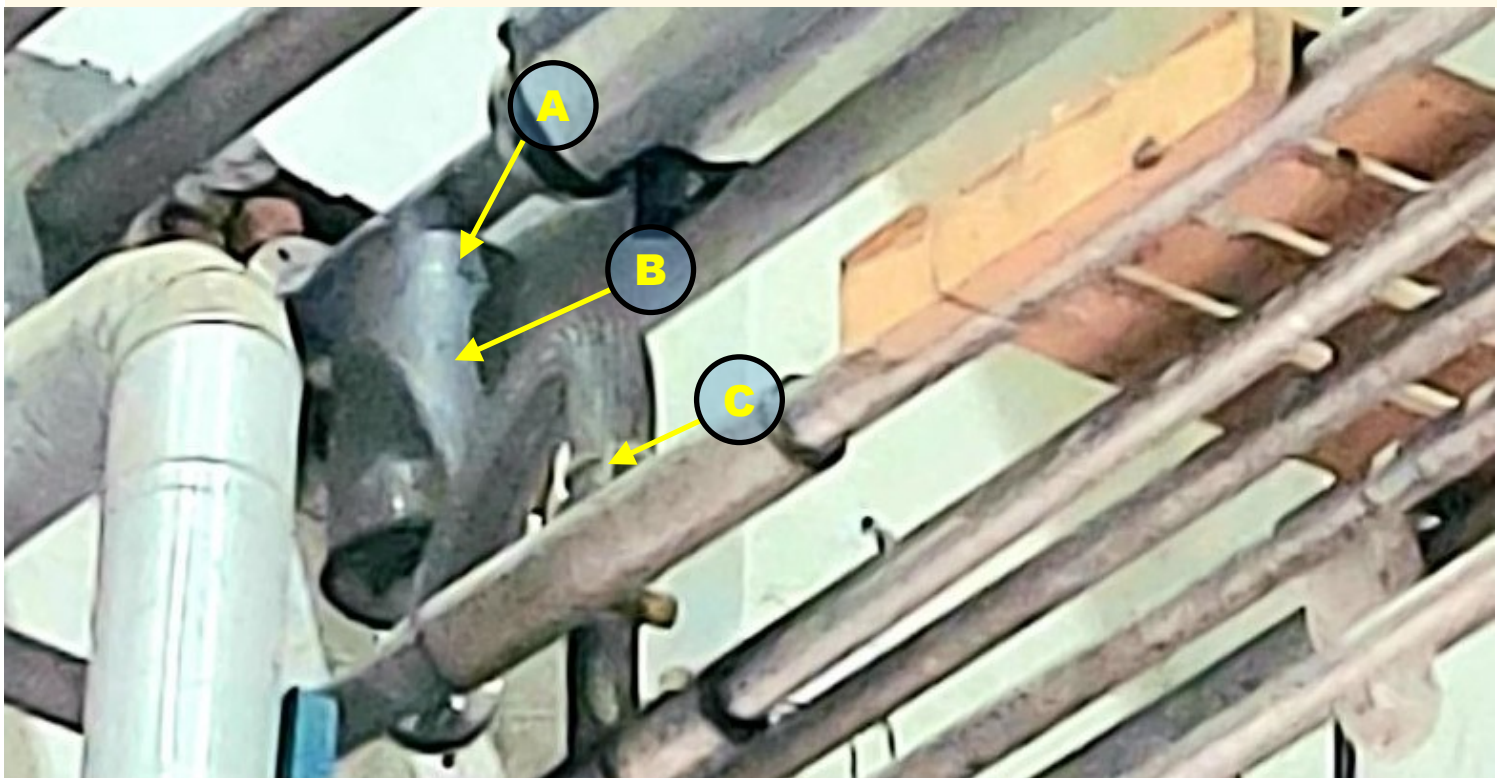
The team visiting the LIGO-India site at Hingoli (Maharashtra)



IPR LIGO-India team with the visiting LIGO members

Development of LN₂ Phase Separator Assembly for 80 K Distribution System of SST-1

In SST-1, sub-cooled liquid nitrogen is used in various sub-systems of 80 K distribution for cooling to reduce the heat load. The LN₂ is returned via a phase separator to the sub-cooler vessel. LN₂ fluid was observed in the main 80 K vent line during the SST-1 campaign. To prevent the huge losses of liquid nitrogen, a similar type LN₂ phase separator assembly was developed. The phase separator assembly consists of a 14-liter SS304 vessel, 1" NB vacuum-jacketed cryo transfer flexible line with ANSI B16.10 face-to-face PTCFE seal non-return valve has been installed and tested successfully in the 3" NB vent line. Miscellaneous tasks were carried out to install an extra phase separator into the LN₂ existing distribution system, like welding, cutting, re-routing of hydraulics, vacuum retention process, helium leak test, thermal insulation, etc. Acceptable vacuum and helium leak rate levels were achieved in the phase separator set-up. The installed system is in progress for performance tests under the operating conditions of the application. It was a technical challenge and a different experience to perform the various tasks at 12 meter in the congested space of many cold piping network.



The phase separator assembly installed on the 80K distribution line of SST-1 (A) 80K vent line (B) Vessel (C) VJ cryoflex line

- ◆ **Ms. Mariammal M**, gave a talk on "Observation of sub-sonic plasma flow in a nonuniform magnetic field in the Helicon Plasma device" at 65th Annual Meeting of the APS Division of Plasma Physics, Colorado, USA, 30 October - 03 November 2023
- ◆ **Mr. Avik Bhattacharya**, gave an invited talk on "Universal circular bellows conceptual design for XRCS edge & survey" at Workshop on Vacuum extension diagnostic systems, from design to operation, ITER, Cadarache, France, 30-31 October 2023
- ◆ **Talks presented at 7th International Conference on Nanostructuring by Ion Beams (ICNIB 2023), Dehradun, 2-4 November, 2023**
 - **Dr. Mukesh Ranjan**, gave an invited talk on "Low energy ion beam for nanostructuring of PTFE bulk and thin film for surface wettability and nanoparticles arrays for sensing applications"
 - **Ms. Sukriti Hans**, gave a talk on "Facet evolution on Si surfaces under low energy Xe ion irradiation: Influence of ion beam parameters"
- ◆ **Dr. Mukesh Ranjan**, gave an invited talk on "Hydrophobic to superhydrophobic transitions in Ar plasma irradiated PTFE surfaces for self-cleaning application" at 13th Asian-European International Conference on Plasma Surface Engineering (AEPSE 2023), South Korea, 5-8 November 2023
- ◆ **Ms. Bhoomi Sandip Gajjar**, gave an overview talk on "IN-DA Progress Report" at 44th Meeting of the ITPA Topical Group on Diagnostics, ITER Organization, France, 6-9 November 2023
- ◆ **Ms. Sukriti Hans**, gave a talk on "Evolution of Triangular Features on Si Surfaces under Low-Energy Ar Ion Irradiation" at 28th International Conference on Nuclear Tracks & Radiation Measurements (ICNTRM-23), Gurugram, Haryana, 6-10 November 2023
- ◆ **Talks presented at 7th Asia-Pacific Conference on Plasma Physics (AAPPS-DPP2023), Nagoya, Japan, 12-17 November 2023**
 - **Dr. Mayur Kakati**, gave an invited talk on "Studies on the retarded recrystallization of tungsten in the CPP-IPR CIRCLE-PSI device"
 - **Mr. Jagannath Mahapatra**, gave an invited talk on "Force-free magnetic island coalescence instability and Shear flow effects"
 - **Mr. Ankit Dhaka**, gave an invited talk on "Spontaneous Fluctuations of Densities in Strongly Coupled Complex Plasmas"
 - **Mr. Krishan Kumar**, gave a talk on "Trapping of wave in a flowing dusty plasma"
 - **Ms. Swarnima Singh**, gave a talk on "Breaking the Hexagonal Lattice Barrier: Experimental Achievement of Square Lattice Formation in 2D Dusty Plasma Crystal"
 - **Mr. Krishan Kumar**, gave a talk on "Trapping of wave in a flowing dusty plasma"
 - **Ms. Yashshri Patil**, gave a talk on "Characteristics Of APPEL Device Long Magnetized Plasma Column Produced Using Hollow Cathode Plasma Source"
- ◆ **Mr. Rajiv Sharma**, gave a Keynote address on "Glass Fiber Reinforced Composites Insulation Material for Cryogenics and Fusion Application" at 3rd International Conference on Material Science & Engineering (ICMSE), NIT, Jalandhar, 23-25 November 2023
- ◆ **Ms. Sukriti Hans**, gave a talk on "Nanopatterns Formation by Low-Energy Ions: Experiment and Simulation" on 28th November 2023
- ◆ **Dr. Margi Jani**, gave a talk on "Indigenous development and optimization of dip coating solutions for Er_2O_3 deposition" on 28th November 2023
- ◆ **Ms. Swarnima Singh**, gave a talk on "Experimental Study of a Quasi two-dimensional Complex Plasma" on 30th November 2023
- ◆ **Talks presented at COMSOL Conference 2023, Bengaluru, 30 November 2023 - 1 December 2023**
 - **Ms. Ananya Kundu**, gave a talk on "2D Transient Magnetic Field analyses of Linear Induction Motor"
 - **Mr. Alli Amardas**, gave a talk on "Electromagnetic Analyses For Indian Tokamaks SST-1 and ADITYA"
- ◆ **Mr. Ravinder Kumar**, gave an invited talk on "Calibration of the ITER ECE Fourier transform spectrometer (FTS)" at Microwave Calibration Workshop, ITER Organization, France, 30 November 2023 - 1 December 2023
- ◆ **Dr. Shaikh Zubin A**, gave a talk on "Excitation of Ion-Acoustic Soliton in a Quiescent Plasma Confined by Multi-Pole Line Cusp Magnetic Field" on 01st December 2023
- ◆ **Dr. Amit Kumar Rana**, gave a talk on "Development of Electrocatalyst and its Implementation in Water Splitting Process" on 02nd December 2023
- ◆ **Dr. Sayantan Mukherjee**, gave a talk on "Experimental investigation on heat transfer enhancement with nanofluids for thermal systems" on 12th December 2023
- ◆ **Mr. Krishan Kumar**, gave a talk on "Excitation of non-linear waves and instabilities in a flowing dusty plasmas" on 12th December 2023
- ◆ **Dr. David Reitz**, Executive Director, LIGO Laboratory, California Institute of Technology, California, gave a talk on "Gravitational-wave Astrophysics with the LIGO-Virgo-KAGRA Network: Where Have We Been, Where Are We, Where Are Going?" on 13th December 2023 (Colloquium #328)
- ◆ **Mr. Sebin Augustine**, gave a talk on "Development of SERS substrate based on self-organized nanoparticles for molecular sensing applications" on 13th December 2023
- ◆ **Prof. Arnab Rai Choudhuri**, IISc, Bangalore, delivered "3rd. A K Sundaram Memorial Lecture" on 14th December 2023
- ◆ **Dr. Subhradeep Chakroborty**, CSIR CEERI Pilani, gave a talk on "Recent Advances in the Research of Microstrip Antennas" on 14th December 2023
- ◆ **Dr. Ram Swaroop**, Central University of Punjab, gave a talk on "Advancing Efficiency in Electron Cyclotron Resonance Ion Sources for Enhanced Ion Acceleration" on 15th December 2023

Upcoming Events

- ◆ Basic Research Needs (BRN) Workshop on Measurement Innovation (MI), Washington DC, USA, 9-11 January 2024 <https://web.cvent.com/event/c6850a60-69dc-489d-9345-1d47a5d704d2/summary>
- ◆ Winter School on "Physics with Trapped Charged Particles", Les Houches, France, 15–26 January 2024; <https://indico.cern.ch/event/1234201/>
- ◆ 44th Workshop on High-Energy-Density Physics with laser and Ion beams, Hirschegg, Austria, 28 January - 2 February 2024; <https://indico.gsi.de/event/18255/>

As a part of IPR's outreach activities, Outreach Division conducted its first solar observation event for students was organized at the Department of Physics, Sardar Patel University at Vallabh Vidyanagar, Anand (Gujarat) on 28th December 2023. This event was organized by the Astronomy Club of the Department of Physics, S.P. University and coordinated by Prof. B. Y. Thakore. Students of BSc and MSc Physics of S. P. University as well as faculty members participated in this event. IPR's solar telescope with high resolution H-Alpha filter was used for this event. Students not only viewed the details of the surface of the sun with the telescope, but also were given information about the telescope, solar imaging techniques, H-alpha filters etc, during the course of the event.



Images from the solar observation event conducted at Sardar Patel University, Vallabh Vidyanagar

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Know Your Colleague



Mr. Naveen Rastogi obtained his B.Tech in Electrical and Electronics Engineering (EEE) in 2009 from Bharati Vidyapeeth College of Engineering, New Delhi. He joined IPR in the Technical Training Program, TTP batch of year 2009. He worked in the Prototype Vacuum division during 2010-2014 as Engineer-SC and from 2014 onwards he has been with the Remote Handling and Robotics Technology Development division. His area of work are remote handling and robotics, development of applications for Virtual Reality, advanced RH control systems and tele-manipulation operations. He has contributed to the establishment of 3-sided, fully immersive VR facility at IPR, design and development of vacuum and high temperature compatible in-vessel inspection system and was also involved in successful completion of ITER-based tasks related to engineering support for ITER RH control systems, RH compatibility and kinematic assessments. He was on deputation for 8 months onsite for a CFE task on ITER RH control systems (Dec 2013 to Jul 2014). He completed his MSc (Engineering) from HBNI in 2019. He has also been a project guide to engineering students. He is also actively involved in science day and outreach activities of IPR. In this capacity, he has developed working models of Remote handling for outreach purposes. His areas of interests are Artificial intelligence, Machine learning, Adaptive control systems.

Plasma Exhibition @ Kozhikode



IPR team with the volunteers from NIT Calicut during the Plasma exhibition held at NIT Calicut

The IPR Newsletter Team

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