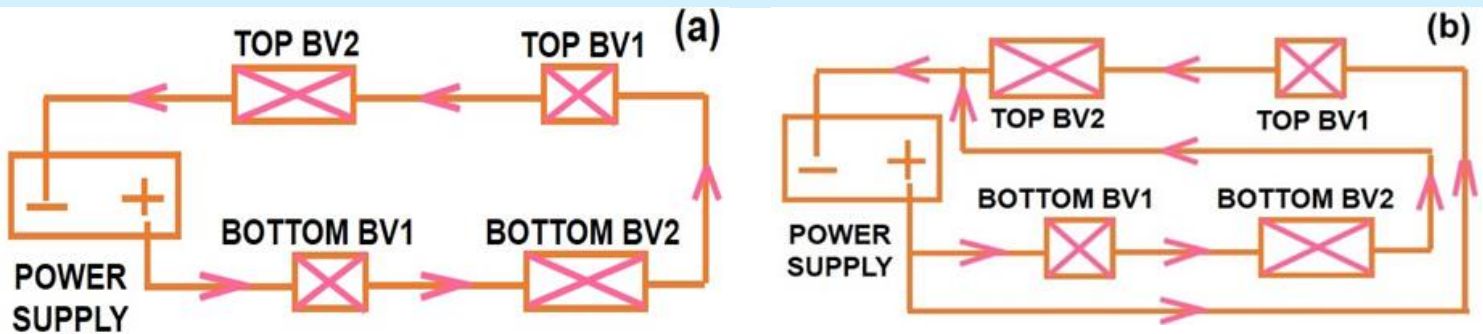
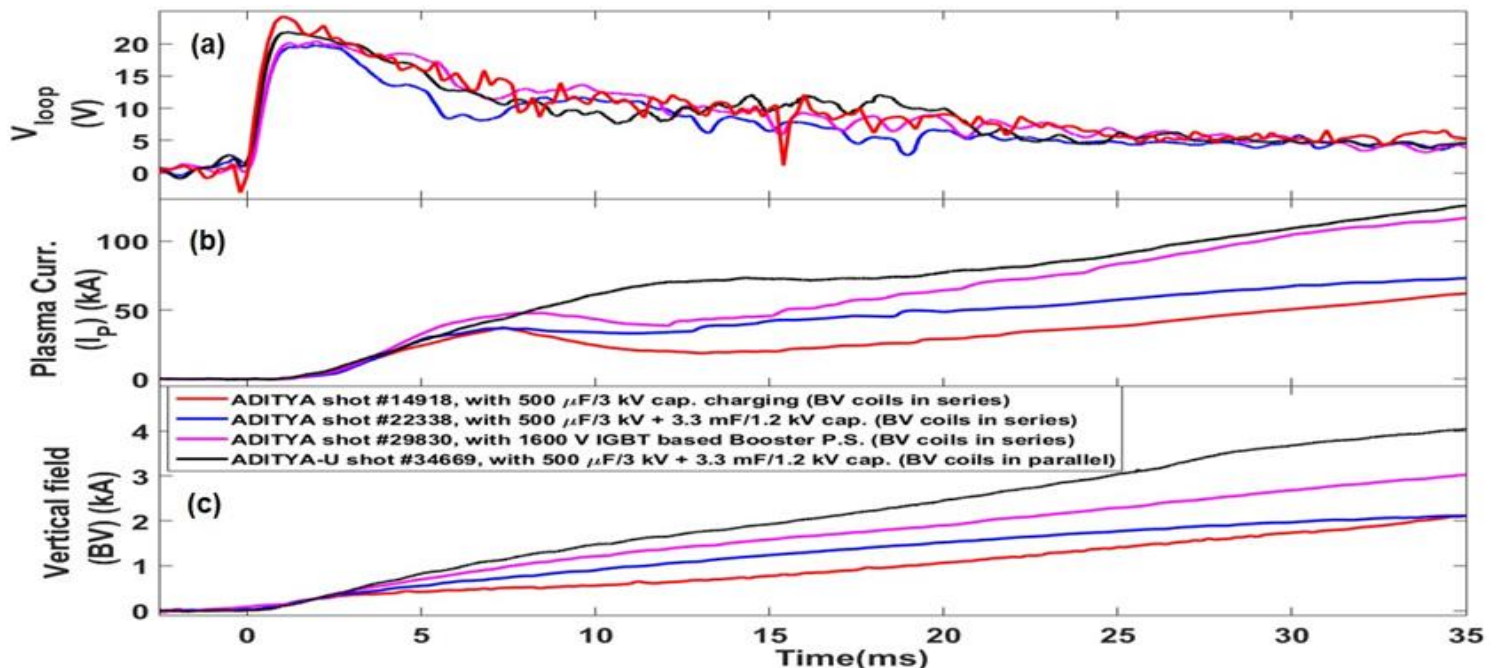


ADITYA-U Plasma Operation With Parallel Configuration Of BV Coils

In a tokamak, the equilibrium of toroidal plasma current column is mainly provided by means of an externally applied vertical magnetic field (BV). ADITYA-U tokamak has two pairs of vertical field coils (namely BV1 & BV2) placed outside the top and bottom of the vacuum vessel equidistant from the horizontal mid-plane in the high and low toroidal magnetic field side provide the require vertical magnetic field (equilibrium field). The require BV in ADITYA-U for plasma current (I_p) of ~ 250 kA is of the order of ~ 1000 Gauss is supplied by the available VF power supply, a 12 pulse converter based system having 2250 V/ 12.5 kA. The major straight vertical field is provided by a set of BV₂ coils and the curvature in the vertical field lines are provided by set of BV₁ coils. The direction of the vertical field is such that as to reduce the net field in the inboard side and enhance it on the outboard side. Usually, these all four BV coils are connected in series to provide vertical field and hence offer a large value of inductance (L) as well as resistance (R). Because of this large L and R, the response time for the coil is slow. Which cannot support the higher I_p ramp-rate due to high L/R time constant of the coils. This causes problems in the initial phase, when plasma current rise is very fast, as well as in the flat-top phase while trying plasma current feedback on BV current with the help of these BV coils. Hence to support the high ramp rate of the plasma current, the only possibility of getting faster response from these BV coils is to reduce overall inductance and resistance of the coil assembly. To achieve this requirement, we have connected top and bottom sets of BV coils in parallel configuration in such a way that the overall symmetry of the machine was not disturbed.



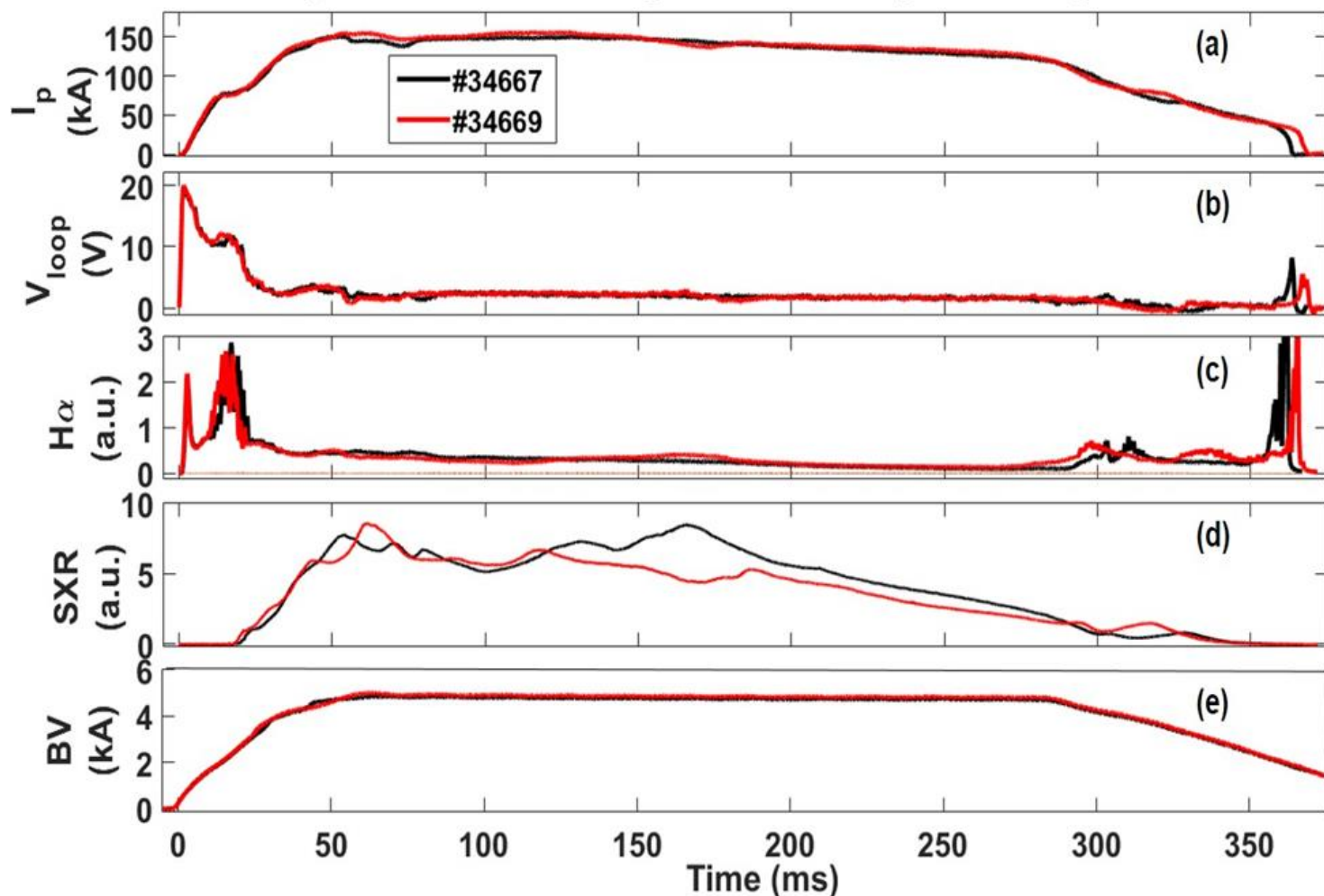
Schematic diagram for BV coils (a) Series configuration and (b) Parallel configuration.



Time evolution of ADITYA /ADITYA-U discharges parameters (a) loop voltage (V) (b) plasma current (kA) and (c) BV current (kA) shows the effect of various shapes of BV current in accordance with plasma performance.

The time evolution of the ADITYA/ADITYA-U plasma parameters represents the effect of various shapes of BV current in accordance with the plasma performance. The highest ramp-rate of I_p and BV current was observed with a parallel configuration of BV coils. Also, for the first time, with the parallel configuration of BV coils, consistent discharges with $I_p \sim 170$ kA, duration (t) ~ 370 ms, and flattop duration > 200 ms have been obtained.

Plasma Pulse length enhancement with Negative convertor in parallel configuration of BV coils



Plasma pulse length enhancement with negative converter in BV parallel mode operation.

Outstanding Reviewers of IPR

IPR congratulates the following scientific officers of IPR for receiving the IOP 2021 Outstanding Reviewer Award for the year 2021. Each journal chooses one person to receive the Reviewer of the Year Award, and selects a number of other excellent reviewers to receive Outstanding Reviewer awards.



Kishore Mishra

High Power ICRH Systems
Division

Plasma Physics and Con-
trolled Fusion



Lavkesh Lachhvani

Fundamental Plasma Experi-
ment Division

Plasma Physics and Con-
trolled Fusion



Mainak Bandyopadhyay

ITER-India

Plasma Physics and Con-
trolled Fusion



Sarveshwar Sharma

Basic Theory Simulations
Division

Plasma Science and Tech-
nology

Campus visits to IPR/FCIPT in the month of April-May, 2022

Date	Name of the Institution	Number of visitors
20-04-2022	Members of <i>Prakalpa</i> Science Club of LD College of Engineering, Ahmedabad	32 BTech students and 2 faculty members
11-05-2022	Indo Science Education Trust, Pune	54 students of +2 and UG
18-05-2022	Silver Oak Institute of Science, Ahmedabad	25 students and 2 teachers
18-05-2022	Participants of YUVIKA programme of SAC-ISRO	29 students and 4 coordinators



Students of Indo Science Education Trust, Pune, during their visit to IPR



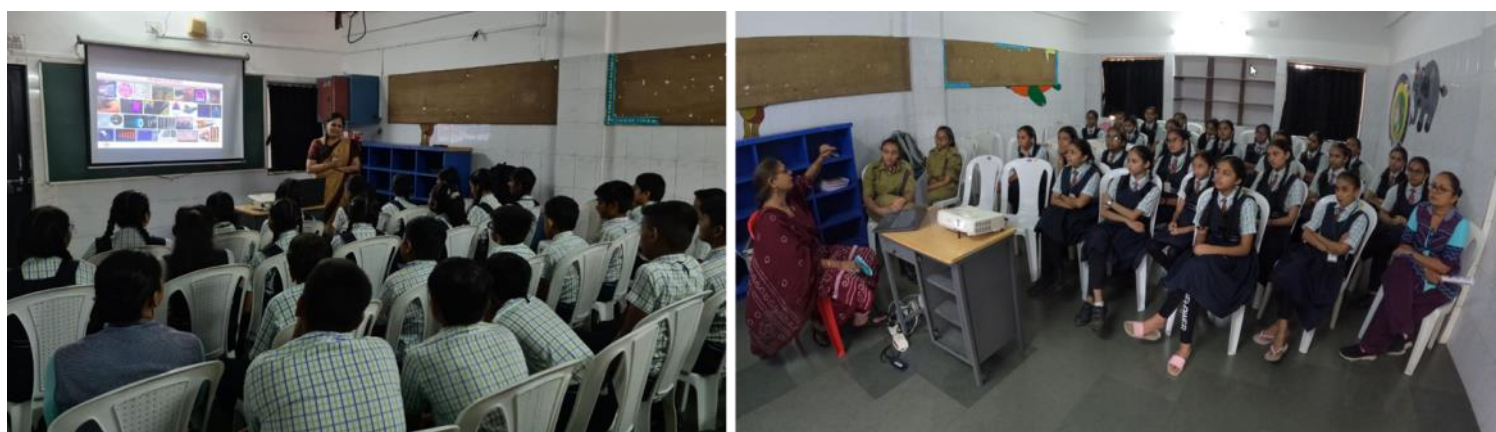
Student participants of the ISRO YUVIKA programme during their visit to IPR

As part of the AKAM celebrations, IPR has been conducting a series of scientific outreach activities in rural schools of different districts of Gujarat. The second such event was conducted during 22-29 April, 2022 at the **Vasishtha Vidhyalaya**, Vav Village, Kamrej Taluka, Surat (Dt). This is a Gujarati /English medium school with over 7000 students studying in classes 1-12. The IPR exhibition on plasma was visited by students from classes 8-12 of both English and Gujarati medium sections.

The 4-day event consisted of a popular talk on plasma and its applications and exhibition of over 15 working models related to plasma and its applications. Over 1000 students of the host school as well students from nearby schools in this taluka visited the exhibition. As part of the event, the Gujarati version of the children's comic book on plasma "*The Wonderful World of Plasma*" was also distributed to all the participating students and teachers. A set of 10 posters on plasma and a popular book on plasma "Living with Plasma" were also distributed to the visiting schools for display in their school's library. IPR Outreach proposes to conduct such events in rural schools of Bhuj and Banaskantha districts in the coming months. Click [here](#) for detailed report.



360 images of the event (click on image to view)



Images from the event



Images from the event

Cryogenic Thermal Insulation on LN₂ Lines of Cryopump Integrated with SST-1

IPR has developed cryo sorption cryo pump using liquid Nitrogen (LN₂). Recently, this cryo pump has been installed at the radial port of SST-1 Vacuum Vessel (VV) as part of evacuation of huge gas load during baking operation in SST-1.

To feed the liquid nitrogen into the cryopump, SST-1 cryo division has designed and installed cryo lines distribution along with valves. To prevent the condensation and frosting on bare LN₂ lines, cryogenic grade flexible elastomer thermal insulation was used to overcome the issues of frosting on these lines.

The thermal performance and validation test of installed insulation has been validated by operating the cryopump in operational condition, no ice frosting and leakage of LN₂ fluid was observed over the cold lines.

Flexible Elastomer Thermal Insulation on Cryo Pump LN₂ Lines



Successful Testing of 100kW Plasma Torch System for 120 Hours

IPR is developing a 5 Tons/day plasma-pyrolysis based biomedical waste disposal plant for deployment at the Homi Bhabha Cancer Hospital, Varanasi. This fully-indigenous, environment-friendly plant, making use of three 100 kilowatt graphite-electrode based plasma arcs, is a contribution to *Atmanirbhar Bharat*. This is the first time that such high-power arcs have been developed in the country for 24 x 7 operation. In a major milestone, these arcs and associated power supplies have been tested continuously for 120 hours. In this testing, the refractory lining were also tested which could maintain the inner wall refractory temperature at 1100 degree C and outer wall temperature of the chamber remains at less than 80 degree C. The plasma arc system was operated using voltage-controlled feedback and current-controlled feedback. This plasma arc system does not require water cooling for electrodes and hence, it has very high electro-thermal efficiency. Demonstration of long duration operation of the plasma arc system with high electro-thermal efficiency (>90% observed during this testing) is very important for its application in high capacity plasma pyrolysis/gasification for environment friendly disposal of organic waste.



(L) The plasma arc as seen through the viewport (R) Plasma arc using graphite electrodes



As part of the *Azadi Ka Amrut Mahotsav*, IPR and the L. D. College of Engineering, Ahmedabad jointly organized a 2-day event during 5-6 May, 2022 to celebrate the National Technology Day. The event was organized by the "*Prakalpa*" Science Club of LDCE, at the EC Department, LDCE Ahmedabad and had the following competitive events;

- ◆ Poster Competition
- ◆ Skit Competition
- ◆ Circuit design
- Technology Quiz
- Science/Technology models by UG students of engineering colleges
- Circuit debugging competition

Apart from the above mentioned competitions, the event also has two popular talks, "*Technologies from Plasma Science: Present day and Future*" delivered by Dr. Shashank Chaturvedi and "*Immersive and interactive visualization*" delivered by Shri. Kandrap Pandya, SAC-ISRO, Ahmedabad on 5th and 6th May respectively.

IPR Outreach also organized an exhibition on plasma, its applications and nuclear fusion which was organized by Outreach Division. Selected members of *Prakalpa* Science Club were trained by IPR Outreach staff to explain all the exhibits to the visitors during the event. Over 67 UG engineering students from 9 engineering colleges across Gujarat participated in the various competitive events and over 2000 students from LDEC and other engineering colleges in Ahmedabad visited the IPR exhibition over the two days. Click [here](#) for a detailed report.



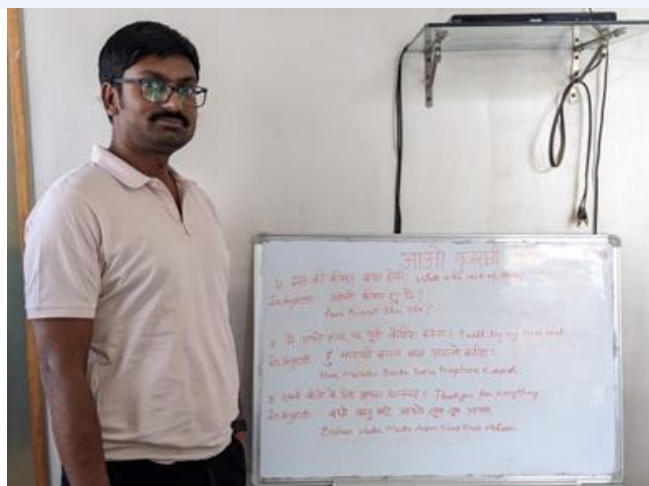
Images from the NTD-2022 event



Images from the NTD-2022 event

आओ एक भाषा सीखें

सरकार ने देश के नागरिकों के लिए देश की 22 अलग-अलग भाषाएँ सीखने के लिए एक नया मोबाइल ऐप 'भाषा संगम' बनाया है। इस ऐप को उपयोगकर्ता निशुल्क डाउनलोड कर 22 भारतीय भाषाएँ सीख सकते हैं। इनमें असमी, बंगाली, गुजराती, हिंदी, कन्नड़, कश्मीरी, कोंकणी, मलयालम, मणिपुरी, मराठी, नेपाली, उड़िया, पंजाबी, संस्कृत, सिंधी, तमिल, तेलुगु, उर्दू, बोडो, संथाली, मैथिली और डोगरी भाषाएँ शामिल हैं। सरकार के इस अभियान को बढ़ावा देने के उद्देश्य से हमारे संस्थान में 'आओ एक भाषा सीखें' प्रतियोगिता का आयोजन किया गया, जिसके तहत प्रतिभागी को भाषा संगम ऐप के जरिए हमारे देश की 22 अलग-अलग भाषाओं में से (अपनी मातृभाषा एवं शिक्षा की भाषा के अलावा) किसी एक भाषा को सीखना था। इसमें भाग लेने वाले प्रतिभागियों ने अपने मोबाइल में 'भाषा संगम' ऐप डाउनलोड कर 22 भाषाओं में से किसी एक भाषा का चयन कर उसे सीखा। भाषा सीखने के लिए MyGovIndia ने एक टेस्ट रखा है, जिसे पास करने के बाद सरकार की तरफ से प्रतिभागियों को एक प्रमाणपत्र भी प्राप्त हुआ है। इस प्रतियोगिता के अगले चरण में प्रत्येक प्रतिभागी द्वारा सीखी गई भाषा में तीन से चार वाक्य संस्थान के नोटिस बोर्ड पर लिखे जा रहे हैं और साथ ही उसका हिंदी और अंग्रेजी अनुवाद भी लिखा प्रस्तुत किया जा रहा है। प्रत्येक प्रतिभागी द्वारा पूरे एक सप्ताह (पाँच कार्यदिवस) रोज अलग-अलग वाक्य लिखे जा रहे हैं। संस्थान के सभी सदस्य नोटिस बोर्ड पर लिखे जा रहे वाक्यों से भारत की विभिन्न भाषाओं में बोले जाने वाले सामान्य बोलचाल के शब्दों/वाक्यों से परिचित होकर लाभान्वित हो रहे हैं।



नोटिस बोर्ड पर सीखी गई भाषा में वाक्य लिखते हुए श्री कनुभाई परमार, श्री अतुल गर्ग एवं श्री रोहित अगरवाल(इटर-भारत में)

Obituary



Dr. Bernard Bigot

(24 Jan 1950 – 14 May 2022)

Dr. Bernard Bigot, Director General, ITER Organization passed away on 14th May 2022 due to illness.

The news of passing away of Dr. Bernard Bigot has come as a shock to all those who have been working for the ITER project. An inspirational leader for more than four decades across multiple fields of science and energy, Dr. Bigot's personal dedication and commitment to ITER over the past seven years shaped every aspect of the project.

His immaculate leadership skills were amply visible in the progress that ITER has made under his leadership. Further, his unending ability to discuss and resolve problems amicably keeping ITER interests had a major role to play in the progress of the project.

We at IPR and ITER-India express our heartfelt condolences to the family members of Dr. Bigot. He will be missed in the years to come as a true leader who had prioritized work over health to ensure that ITER progresses continuously towards achieving the goals in the shortest time frame.

- ◆ **Mr. P. Vadivel Murugan**, gave an invited talk on "*Thermal Plasma for Industrial Waste Management*" at a webinar on Waste to Wealth: Towards \$ 5 trillion economy, MS University, Baroda, on 4th April 2022
- ◆ **Dr. Jervis Ritesh Mendonca**, gave a talk on "*Computational studies of current driven instabilities in a tokamak plasma*" at APS April Meeting, New York City, USA, on 11th April 2022
- ◆ **Dr. Rajashree Sahoo**, gave a talk on "*Milling effect on the performance of photocatalytic dye degradation using different photocatalysts*" on 25th April 2022
- ◆ **Mr. Hariprasad MG**, gave a talk on "*Experimental Investigation of Complex Plasma Crystals in a DC Glow Discharge Plasma*" on 26th April 2022
- ◆ **Dr. Ipsita Das**, Indian Institute of Technology, Kharagpur, gave a talk on "*Design aspects of High-Temperature Superconducting (HTS) power cables*" on 29th April 2022
- ◆ **Dr. Nishanth Katam**, Indian Institute of Science, Bangalore, gave a talk on "*Plasma Catalysis for NO_x and THC Removal using Industrial Wastes*" on 06th May 2022
- ◆ **Ms. Pawandeep Kaur**, gave a talk on "*Molecular Dynamics study of Convection Cells in 2D Yukawa liquids*" on 12th May 2022
- ◆ **Dr. Kajal Garg**, Dayalbagh Educational Institute, Agra, gave a talk on "*Impact of Cosmic Rays in Real Life*" on 13th May 2022

Upcoming Events

- ◆ The European Physical Society (EPS) Forum, Paris, France, 2-4 June 2022. <https://epsforum.org/>
- ◆ 16th Kudowa Summer School "Towards Fusion Energy" Kudowa Zdroj, Poland, 6-10 June 2022. <https://kudowaschool.ipplm.pl/>
- ◆ 4th International Conference on the History of Physics, Ireland, 8-10 June 2022. <https://www.iop.org/events/4th-international-conference-history-physics>
- ◆ One day meeting on Plasma Surfaces and Thin Films, London, UK, 9 June 2022. <https://www.iop.org/events/plasma-surfaces-and-thin-films>
- ◆ 10th Nordic Conference on Plasma Spectrochemistry, Norway, 12-15 June 2022. <http://nordicplasma.com/>
- ◆ The Technology of Fusion Energy (TOFE 2022), Anaheim, United States, 12-16 June 2022. <https://www.ans.org/meetings/file/view-1137/>
- ◆ American Nuclear Society (ANS) Annual Meeting, Anaheim, CA, USA, 12-16 June, 2022. <https://www.ans.org/meetings/am2022/>
- ◆ 25th International Conference on Plasma Surface Interaction in Controlled Fusion Devices (PSI-25), Korea, 13-17 June 2022. <https://psi2022.kr/>
- ◆ IEEE International Power Modulator and High Voltage Power Conference (IPMHVC) and IEEE Electrical Insulation Conference, Knoxville, USA, 19-23 June 2022. <https://ipmhvc-eic-2022.com/>
- ◆ 2nd International Conference on Plasma Theory and Simulations (PTS -2022), University of Lucknow, 20-21 June, 2022. <https://www.pts2022.com/>
- ◆ 22nd International Cryocooler Conference (ICC22), Bethlehem, USA, 27-30 June 2022. <https://cryocooler.org/>
- ◆ MEM & HTS4Fusion Conductor Workshop 2022, Germany, 26 June-01 July 2022. <https://www.itep.kit.edu/mem-hts4fusion2022/>
- ◆ 14th European Conference on Atoms Molecules and Photons (ECAMP14), Vilnius, Lithuania, 27 June - 1 July 2022. <https://www.ecamp14.org/>
- ◆ 48th European Physical Society Conference on Plasma Physics, Maastricht, Netherlands, 27 June 2022 - 01 July 2022. <https://www.epsplasma2022.eu/>

Know Your Colleague



Mr. Atul Garg joined IPR in 2008 as an Engineer-SC and currently serving as Scientific Officer-E in SST-1 Cryogenic Division.

He significantly contributed initially in the in-house series production of ten pairs of 10 kA rated vapour cooled current leads and commissioning of Current Feeder System (CFS) for SST-1. He has participated in TF superconducting coils test program at IPR. He has vast experience in mechanical engineering aspects of complex assemblies like CFS as well as vapour cooled, HTS and MgB₂ based current leads specifically utilized for the SST-1 and cryogenic experiments.

He is mainly responsible for up-gradation, maintenance and operation of superconducting CFS for SST-1 plasma campaigns. Concurrently, he is actively involved in the design, development of current leads. He is a member of Institution of Engineers (India) and life member of Indian Cryogenic Council.

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Visit of ISRO-YUVIKA Programme Students to IPR



Images from the visit of ISRO-YUVIKA students to IPR

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