

Issue 118

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# The Fourth State

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



## MoU Between DAE and Gujarat Science City

On 27th March, 2023, a Memorandum of Understanding (MoU) was signed between Shri K. N. Vyas (Chairman AEC and Secretary, Department of Atomic Energy) and Shri Vijay Nehra, IAS, Secretary, Department of Science & Technology, Government of Gujarat in the presence of Hon. Chief Minister of Gujarat, Shri Bhupendrabhai Patel at the Chief Minister's office. This MoU is regarding establishment of a permanent exhibition pavilion at the Gujarat Science City. This exhibition will showcase the achievements of the Department and will also have a pavilion on plasma. While IPR was represented by Dr. Shashank Chaturvedi (Director) and Dr. A. V. Ravi Kumar (Head Outreach Division), Government of Gujarat was represented by Chief Secretary Shri Raj Kumar and Shri Reetesh Chaurasia (Member, SOPC, DAE) from DAE.



The MoU being exchanged between Shri K. N. Vyas and Shri. Vijay Nehra in the presence of Hon. CM and Chief Secretary, GoG



Images from the signing of the MoU



## Inauguration of EHCL and Neutronics Laboratories

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On 27th March, 2023, Shri K. N. Vyas (Chairman AEC and Secretary, Department of Atomic Energy) inaugurated the Experimental Helium Cooling Loop (EHCL) as well as the Neutronics Laboratories in the IPR main campus.

Helium is an attractive coolant for fusion power plant applications. An Experimental Helium Cooling Loop (EHCL) facility has been successfully installed and commissioned at IPR. It is a scaled down system of First Wall Helium Cooling System (FWHCS) of a fusion blanket module. The major components of this loop are: circulators, heater, recuperator, coolers, compressors and Test Section etc. Helium pressure and inventory in the loop is maintained by Pressure and Inventory System (PICS). This system will be integrated with the High Heat Flux Test Facility (HHFTF) to provide helium as a coolant during high heat flux testing.



The Experimental Helium Cooling Loop (EHCL) lab being inaugurated



Shri K. N. Vyas visiting the EHCL and the HHFTF labs



During the visit to EHCL and HHFTF facilities



Neutron & Ion Irradiation Facility is an accelerator-based 14-MeV D-T neutron source with a design yield of  $5 \times 10^{12}$  n/s. A Deuterium ion beam produced from a 2.45 GHz ECR source is accelerated by a 300 kV high voltage power supply and impinging on a Titanium Tritide (TiT) thin-film target. A neutron yield of  $7 \times 10^{11}$  n/s has been achieved in early testing. The NIIF is equipped with various neutron diagnostics system i.e. foil activation, diamond detector, associated alpha particle detector, and He-3 detector to measure the neutron yield. It is also equipped with state of the art tritium handling & recovery system to recover tritium sputter/outgassing during bombardment of the deuterium beam on the tritium target. The AERB has already accorded Commissioning Approval for the facility. The 14 MeV neutrons generated in NIIF will be used to study irradiation effects on various functional and structural materials used in fusion blankets. This facility will also be utilized for benchmark experiments in a variety of areas, like double differential cross-section, neutron spectroscopy, Fusion Evaluated Nuclear Data (FENDL), neutron imaging, medical isotope production, neutron diagnostic development, etc.



Shri K. N. Vyas inaugurating the Neutronics Lab



Shri K. N. Vyas visiting the Neutronics Lab after the inauguration.



Shri K. N. Vyas with IPR scientists at the Neutronics lab





(L) The 14 MeV D-T neutron source and accelerator (R) Schematic of the EHCL facility



(L& M) In the EHCL control room (R) at the EHCL facility



At the Neutronics Laboratory



Facilitation of Chairman and other senior scientists who were involved in the development of the Neutronics Lab



## Plasma Exhibition @ Science Carnival 2023

IPR participated in the "Science Carnival-2023" organized by the Gujarat Council of Science City as part of the National Science Day. The exhibition was organized at the Gujarat Science City during 28-Feb to 4-Mar, 2023. The event was inaugurated by Hon. Chief Minister of Gujarat, Shri Bhupendrabhai Patel, who then visited the IPR exhibition and interacted with IPR staff present there.

Undergraduate science students from the M.G. Science Institute as well as Silver Oak University, Ahmedabad were trained as technical volunteers for the IPR exhibition to explain the exhibits to the visiting public. Over two lakh people visited the exhibition.

IPR stall also won the "Best Innovation Exhibit" award at the Science Carnival 2023. This award was presented to the IPR team during the concluding ceremony. More details are available [HERE](#).



Hon. Chief Minister of Gujarat, Shri Bhupendrabhai Patel and Shri Vijay Nehra, IAS, Secretary, Department of Science & Technology, Government of Gujarat visiting the IPR exhibition.







Images from the Science Carnival 2023



IPR receiving the "Best Innovation Exhibit" award at the Science Carnival 2023



Date	Institution	Visitors
20-Mar-2023	Indian Institute for Teachers Education, IITE, Gandhinagar	43 students (B.Ed/M.Ed) and 2 faculty
27-Mar-2023	National Forensic Science University, Gandhinagar	43 UG/PG students of forensic sciences
28-Mar-2023	Industrial Training Institute (I.T.I), Kubernagar, Ahmedabad	46 students of diploma in engineering
4-Apr-2023	D. D. Choksi College of Secondary Education, Palanpur	56 students of B.Ed (Science)
10-Apr-2023	Indus Institute of Technology & Engineering , Ahmedabad	51 students of BTech and 1 faculty



Students and faculty from Indian Institute for Teachers Education (IITE), Gandhinagar during their visit to IPR



Students and faculty from Industrial Training Institute (I.T.I), Kubernagar, Ahmedabad during their visit to IPR



Students and faculty from Indus Institute of Technology & Engineering , Ahmedabad during their visit to IPR



Date	Institution	Visitors
24-Mar-2023	Guwahati University, Guwahati	14 students of MSc in Instrumentation and Applied Physics, 2 Research Scholars and 1 faculty
24-Mar-2023	Shillong College, Shillong	52 students of BSc Physics and 4 faculty



Students from Guwahati and Shillong during their visit to CPP-IPR



Students visiting various labs in CPP-IPR

## High Voltage Power Supply for IGCAR

A 25 KW Pulsed HV DC power Supply has been successfully integrated with existing Plasma Nitriding System at Indira Gandhi Centre of Atomic Research (IGCAR), Kalpakkam, Tamilnadu. The integrated Plasma Nitriding System will be used to nitride the Nuclear reactor components. Few test runs of plasma Nitriding process have carried out and post Plasma Nitriding Parameters were found to be satisfactory. The team members from FCIPT for this project were Team Members: Mr. Naresh Vaghela (Project Manager), Mr. Ghanshyam Jhala, Ms. Keena Kalaria, Dr. Alphonsa Joseph and Dr. Suryakant B. Gupta

Parameter	Requirement
Voltage	0 to -800 V variable
Power	25.6 KW max. (Load dependent)
Frequency	20 KHz fixed
Duty cycle	10% to 80% variable
Temperature measurement on HV floating components	0 to 700 degree centigrade
Protections	Over current, Over voltage and Short circuit protections



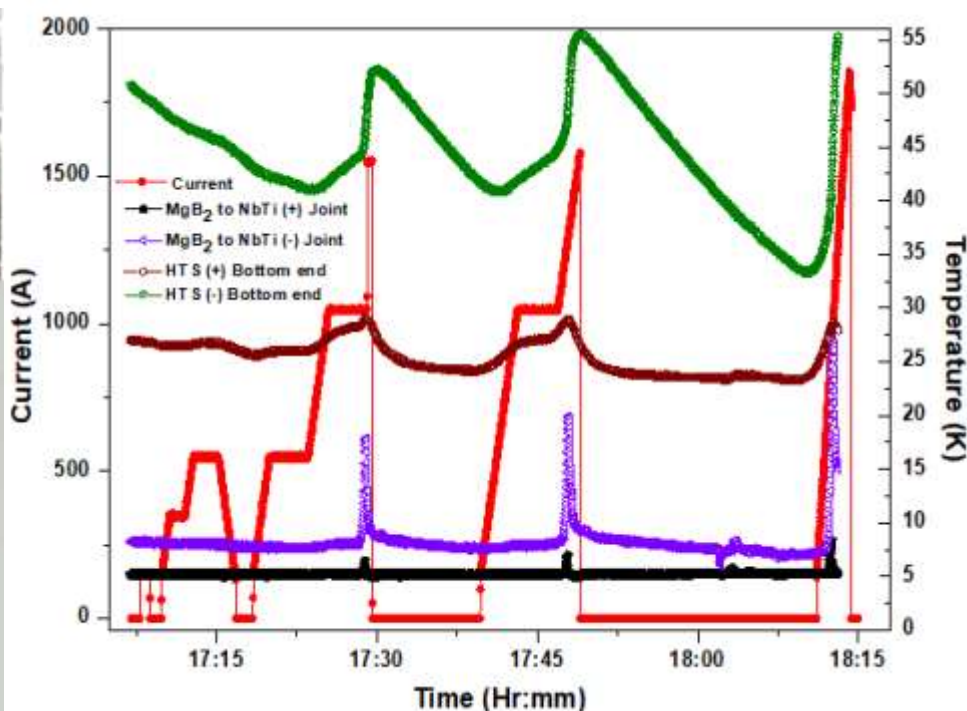
(L) The specifications of the Pulsed HV DC power supply (R) High voltage power supply integrated with Plasma Nitriding System at IGCAR Kalpakkam



In Tokamaks, high magnetic fields are produced using superconducting (SC) magnet systems. A superconducting magnets system comprises of low temperature superconductor (LTS) based electromagnets, their SC current feeders and current leads. Normally LTS magnets system are cooled around  $-267^{\circ}\text{C}$  using expensive liquid helium for achieving superconductivity, a near zero loss state. They also require very thin window of temperature for smooth operation and are highly susceptible to quench (transition to normal state from super conducting state). In certain dynamic operational conditions, the SC current feeders system and their joints are even prone to accidents leading to shut down of these large devices for long durations.

In comparison to conventional LTS current feeders system, High Temperature Superconducting (HTS) based current feeders have potential benefits in terms of better temperature margin, less cryo operational cost and better cryo-stability for operating large scale SC magnets. The heat exchanger of the HTS current leads can be cooled using much cheaper liquid nitrogen at around  $-196^{\circ}\text{C}$  instead of expensive liquid helium. As a proof of concept, a prototype 3.3 kA rated HTS current lead with  $\text{MgB}_2$  (magnesium diboride, superconducting near  $-234^{\circ}\text{C}$ ) wires as intermediate joints between bottom HTS module (ceramic based HTS tapes, superconducting near  $-183^{\circ}\text{C}$ ) and NbTi (niobium-titanium alloy) shunt is recently tested.

The HTS current leads and its bottom  $\text{MgB}_2\text{-Cu-NbTi}$  shunt are tested in cold conditions up to 1.5 kA in a dedicated experimental test set-up having precise instrumentation and diagnostics. The test results of prototype current leads are being analyzed for detailed understanding. As a next step, we have replaced  $\text{MgB}_2\text{-NbTi}$  shunt with a meter long complete  $\text{MgB}_2$  shunt between HTS current leads pair for overcoming the issues for operation of current leads up to the rated current of 3.3 kA. These developments could provide cost effective solution for future large scale applications.



(L) HTS CL equipped with all instruments on test stand (R) Temperature evolution during current charging at different superconducting joints section.

## Talks @ Seminars

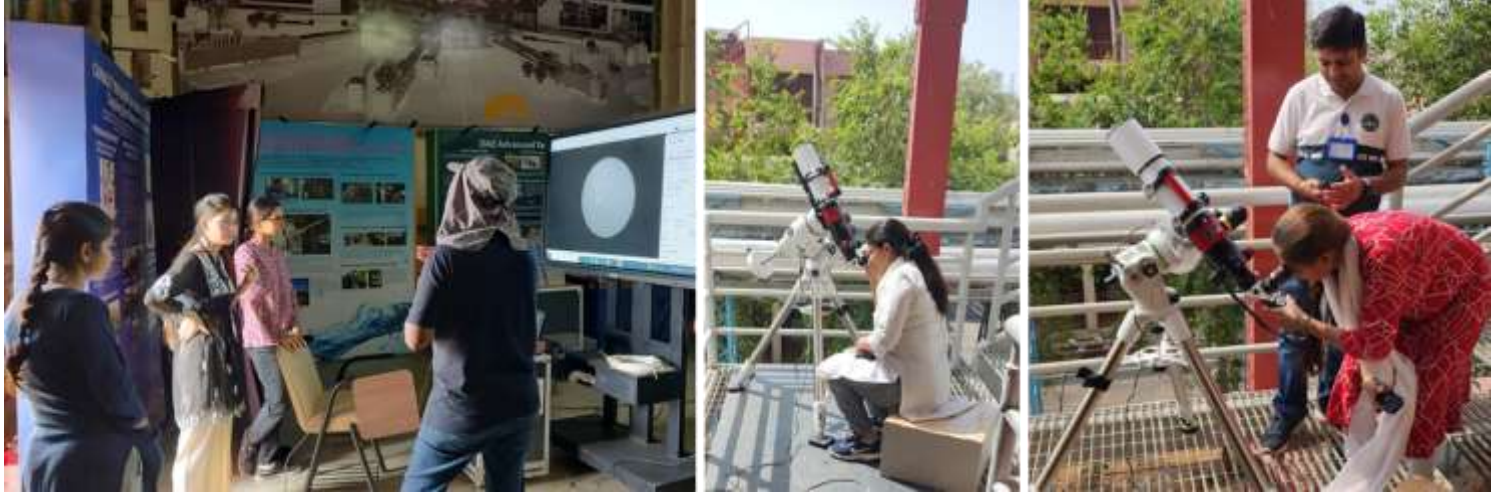


Dr. Vishal Jain delivered a talk entitled "Plasma Pyrolysis Technology at IPR " at the "Swachhata and Hygiene" seminar held at BARC on 28-Mar-2023 under the auspices of the Atomic Energy Education Society.



As part of IPR's outreach activities, a solar imaging telescope has been installed at the ORD hall in the new laboratory building. This scope is capable of viewing the surface of the sun in both red (656.28 nm tunable H-alpha filter with a low bandpass of  $<0.05\text{nm}$ ) as well as in UV (393.4nm, Calcium-K). These filters will enable one to see in detail, the various features on the surface of the sun, such as Prominences, Filaments, Plages, Flares, Chromospheric Network, Spicules etc., which would not be visible otherwise.

Details of the telescope system can be seen on the [ORD website](#). In future, once the scope is properly installed and tested, ORD plans to organize regular viewing sessions for IPR staff and possibly even have live view of the sun made available on the ORD website for anyone to observe. ORD also plans to organize solar observation events for school/college students during their visit to IPR.



(L) Image from the telescope being viewed on the large screen (R) IPR staff viewing the sun using the telescope





होटल प्रबंधन संस्थान, गांधीनगर द्वारा दिनांक 29.03.2023 को नराकास गांधीनगर के सौजन्य से ऑनलाइन माध्यम से हिंदी कार्यशाला का आयोजन किया गया। इस कार्यशाला में गांधीनगर में स्थित केंद्र सरकार के कार्यालयों/संगठनों/बैंकों के कर्मिकों ने भाग लिया। प्लाज्मा अनुसंधान संस्थान की हिंदी अधिकारी डॉ.संध्या दवे ने इस कार्यशाला में “कंप्यूटर पर हिंदी प्रयोग हेतु उपयोगी टूल्स” विषय पर प्रशिक्षण प्रदान किया। इस प्रशिक्षण सत्र में उन्होंने कंप्यूटर पर आसानी से हिंदी भाषा को सक्रिय करने एवं विभिन्न प्रकार के यूनिकोड फॉन्ट का प्रयोग करने के साथ राजभाषा विभाग की वेबसाइट पर उपलब्ध हिंदी प्रयोग संबंधी विभिन्न टूल्स के बारे में जानकारी प्रदान की। साथ ही हिंदी अनुवाद हेतु मशीन ट्रांसलेशन की सहायता लेने के साथ सावधानी बरतने का सुझाव दिया। स्पेल चेकर की सहायता से आसानी से वर्तनी को सुधारने और वॉइस टाइपिंग टूल्स की भी जानकारी प्रदान की। उन्होंने प्रशिक्षण के अंत में श्रोताओं के संदेहों को दूर किया। कंप्यूटर पर आसानी से हिंदी प्रयोग के लिए उपयोगी टूल्स पर यह कार्यशाला श्रोताओं के लिए ज्ञानवर्धक रही।

## Past Events @ IPR

- ♦ **Mr. Robert Pearce**, ITER Organization, France, gave a talk on “Progress in the Realization of ITER Vacuum Systems and Maintaining Vacuum Quality” on 22nd March 2023 (Colloquium 323)
- ♦ **Mr. Soumen De Karmakar**, gave a talk on “Collective dynamics of active or self-propelled particles” on 27th March 2023
- ♦ **Dr. Gajendra Singh**, Guru Gobind Singh Indraprastha University (GGSIU), Dwarka, gave a talk on “Spectroscopy of highly charged ions significant to astrophysics and laboratory plasma diagnostic studies” on 31st March 2023
- ♦ **Dr. Prabhakar Tripathi**, gave a talk on “Simulation Investigation of a View Dump for Vertical Electron Cyclotron Emission (VECE) Diagnostic System” on 05th April 2023
- ♦ **Mr. Kirankumar G. Patel**, gave a talk on “FPGA based real time density feedback control system for ADITYA-U tokamak” on 6th April 2023
- ♦ **Dr. Santosh Konuru**, Vellore Institute of Technology, Tamilnadu, gave a talk on “Tungsten-Tantalum Thin Films Performance in Fusion Tokomaks” on 17th April 2023
- ♦ Dr. Rajashree Sahoo, gave a talk on “Solar photocatalytic dye degradation using Zn<sub>2</sub>TiO<sub>4</sub> catalyst and LIBS study using Li<sub>2</sub>TiO<sub>3</sub> pellet” on 19th April 2023

## Upcoming Events

- ♦ Nuclear and Emerging Technologies for Space (NETS 2023): Powering the Next Era of Space Exploration, Snake River Event Center, USA, 7-11 May 2023; <https://www.ans.org/meetings/nets2023/>
- ♦ 14th International Particle Accelerator Conference (IPAC'23), Venice, Italy, 07-12 May 2023; <https://www.ipac23.org/>
- ♦ 15th Karlsruhe International School on Fusion Technologies, Karlsruhe, Germany, 8-12 May 2023; <https://summerschool.fusion.kit.edu/index.php>
- ♦ 21st International Conf. on Atomic Processes in Plasmas, Austria, 15-19 May 2023; <https://conferences.iaea.org/event/238/>
- ♦ International Conference on Nuclear Decommissioning: Addressing the Past and Ensuring the Future, Vienna, Austria, 15-19 May 2023; <https://www.iaea.org/events/decom2023>
- ♦ IAEA Technical Meeting on Atomic Processes in Plasmas, IAEA Headquarters, Vienna, 15-19 May 2023; <https://www.iaea.org/events/evt2103110>
- ♦ 50th IEEE International Conference on Plasma Science (ICOPS 2023), Santa Fe Plaza, New Mexico, 21-25 May 2023; <http://ece-events.unm.edu/icops2023/>
- ♦ 25th International Symposium on Plasma Chemistry, Kyoto, Japan, 21-26 May, 2023; <https://www.ispc25.com/>
- ♦ 19th International Conference on Plasma-Facing Materials and Components for Fusion Applications, Bonn, Germany, 22-26 May 2023; <https://www.shorturl.at/bwBH4>
- ♦ European Conference on Magnetic Reconnection in Plasmas, Marseilles, France, 23-26 May 2023; <https://ecmrp.sciencesconf.org/>
- ♦ International Workshop on Models and Data for Plasma-Material Interaction in Fusion Devices, Aachen, Germany, 29-31 May 2023; <https://amdis.iaea.org/meetings/mod-pmi-2023/>
- ♦ AGU Chapman Conference on Advances in Understanding Alfvén Waves in the Sun and the Heliosphere, Berlin, Germany, 28 May-02 June 2023; <https://www.agu.org/Chapman-Alfvén-Waves>



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### Know Your Colleague



**Mr. Bhavinkumar Baldevbhai Amin** completed his B.E. in Electrical engineering after which he joined IPR in June 2009 as Engineer- SC with the Infrastructure group at IPR. Currently he is working in Electrical Distribution and Aditya Power Section under Power Systems Division as Scientific Officer-E and is looking after electrical maintenance work for utility power and electrical work for upcoming infrastructure in the Institute.

Some of the major works undertaken by him at IPR include electrical work of New Laboratory Building, Auxiliary Building, New Office Building and Married Student Hostel (MSH) building. He is currently also involved in the ongoing process of replacement of conventional light fixtures with energy saving LED light fixtures in the campus.

### Plasma Exhibition @ Science Carnival-2023



IPR Team along with the student volunteers of the IPR exhibition at the Science Carnival-2023

### The IPR Newsletter Team

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