

Issue 067

February 2019

The Fourth State

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

70th Republic Day Celebrations @ IPR

IPR celebrated the 70th Republic Day on 26 Jan 2018. The Indian tricolor was unfurled by Director, Dr Shashank Chaturvedi. He then spoke about the various achievements of IPR in the last year. This was followed by refreshments. Two seminars on social health, viz, on “*Social Media Addiction: Its Benefits & Disadvantages, Tips to Control & How to Prevent*” by Ms. Iti Shukla, Clinical Psychologist of Sterling Hospital, Ahmedabad, and “*Healthy Mind, Healthy Body*” by Dr. R. C. Damani, Senior Physician of Zydus Hospital, were delivered. A free health-check-up for those who were present at IPR for the function was also organized by Sterling Hospital. Various sports activities were also organized for the children and family members of IPR staff. The event ended after lunch. Over 300 IPR staff and their family members attended the function which was organized by the Staff Club.



Clockwise from top : Director IPR delivering his speech after the flag hoisting. Enthusiastic IPR'ites celebrating the event.
View of the IPR staff assembled for the flag hoisting.



Images from the Republic day celebrations at IPR

70th Republic Day Celebrations @ CPP-IPR

The 70th Republic Day was celebrated at CPP-IPR. Prof. B. K. Saikia, Centre Director, hoisted the national flag. Mr. Donney Jigdang, a research scholar, presented a talk on Indian Constitution followed by a documentary show on India's independence struggle and an open quiz competition among the employees and their family members.



Images from the Republic day celebrations at CPP-IPR

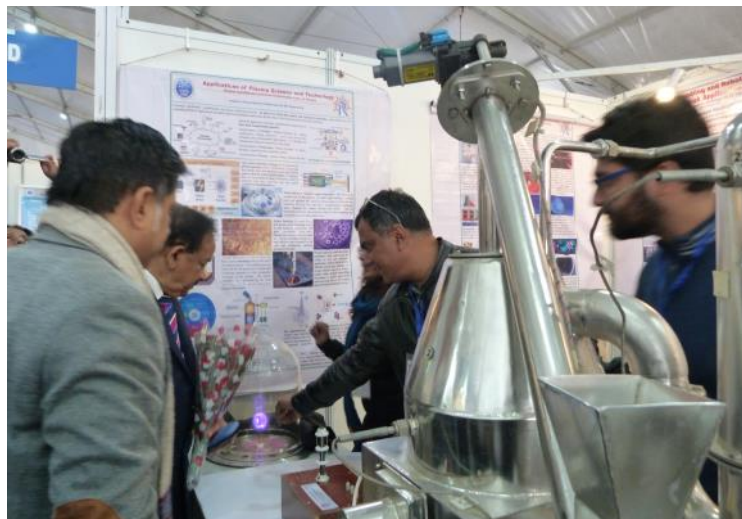
IPR participated in the "Pride of India" exhibition which was held as part of the 106th Indian Science Congress which was held at Lovely Professional University, Phagwara, Punjab during 4-7 January, 2019. The exhibition was inaugurated on 4th January by Dr. Harsha Vardhan, Honourable Minister of Science & Technology, Government of India. IPR's stall was part of the DAE Pavilion which also had exhibits from other units of DAE. The IPR team attending this event consisted of Chhaya Chavda, K K Mohandas, Harsha Machchhar, Narendrasinh Chauhan and Ravi A V Kumar. Various interactive as well as static models depicting technologies developed by IPR were displayed. Over 6,000 visitors visited the exhibition during the duration of the Science Congress. The DAE pavilion won the "Most Informative Pavilion" award of the exhibition.



The Pride of India Exhibition at the 106th Indian Science Congress.



IPR team and IPR's stall at the Science Congress



Dr. Harsh Vardhan, Cabinet Minister, at IPR's stall along with Shri. Ravi Shankar, Head, PAD, DAE

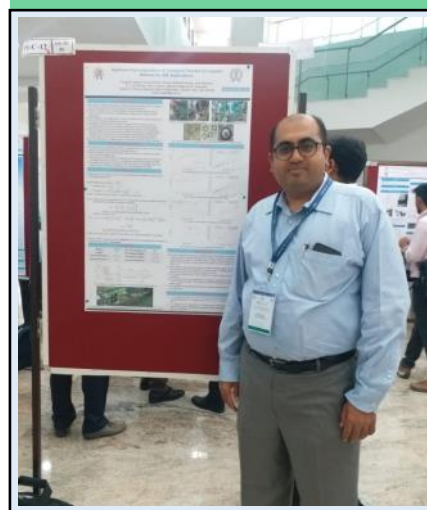


Visitors at the IPR exhibition stall



(L) The Chancellor and Pro-Chancellor of Lovely Professional University at IPR stall. (R) IPR participants with the award received for the DAE Pavilion.

IPR@ Conferences



Mr. Pradip N. Panchal, Scientific Officer - F, SST-1 Cryogenics Division, presented a poster entitled "Hydraulic Characterization of Flexible Corrugated Pipes for 80K HTS Applications" at the 27th National Symposium on Cryogenics and Superconductivity at IIT Mumbai during 16-18 January 2019.



Mr. Nitin Bairagi, Scientific Officer - D, SST-1 Cryogenics Division, presented a poster entitled "Development of Lab Scale Subcooled Liquid Nitrogen Facility for HTS Applications" at the 27th National Symposium on Cryogenics and Superconductivity at IIT Mumbai during 16-18 January 2019.

Visit of DAE Chairman to IPR

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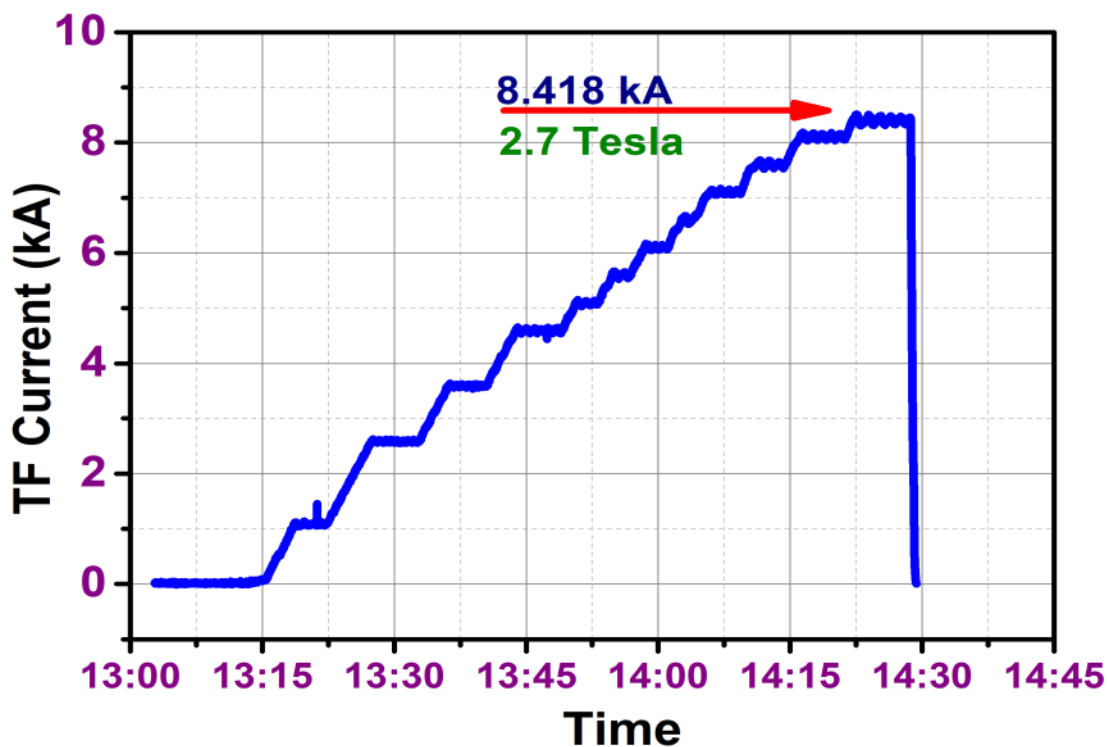
Shri K. N. Vyas (Secretary DAE, Chairman AEC and Director BARC) visited IPR on Friday, 18th Jan 2019. Accompanied by Director IPR and Project Director, ITER-India, Shri Vyas visited the ITER-India lab and was briefed about the progress of the ongoing R&D & experimental activities and those related to ITER deliverables. Shri Vyas also visited Aditya, SST-1, Neutronics and other labs in IPR campus and observed the progress of various ongoing activities.



Images from DAE Chairman's visit to ITER-India and IPR

For the first time in SST-1 tokamak, the toroidal magnetic field was raised to 2.7 Tesla, which is 90% of the design value of 3 Tesla. The toroidal field was raised in steps, as shown in the figure and was kept above 2 Tesla for more than 15 minutes.

This is a very good demonstration in terms of the planned experiments for future campaigns, where long-pulse plasma operation above 2 Tesla would be done with the assistance of Electron Cyclotron Resonance, Lower Hybrid and Ion Cyclotron Resonance systems.

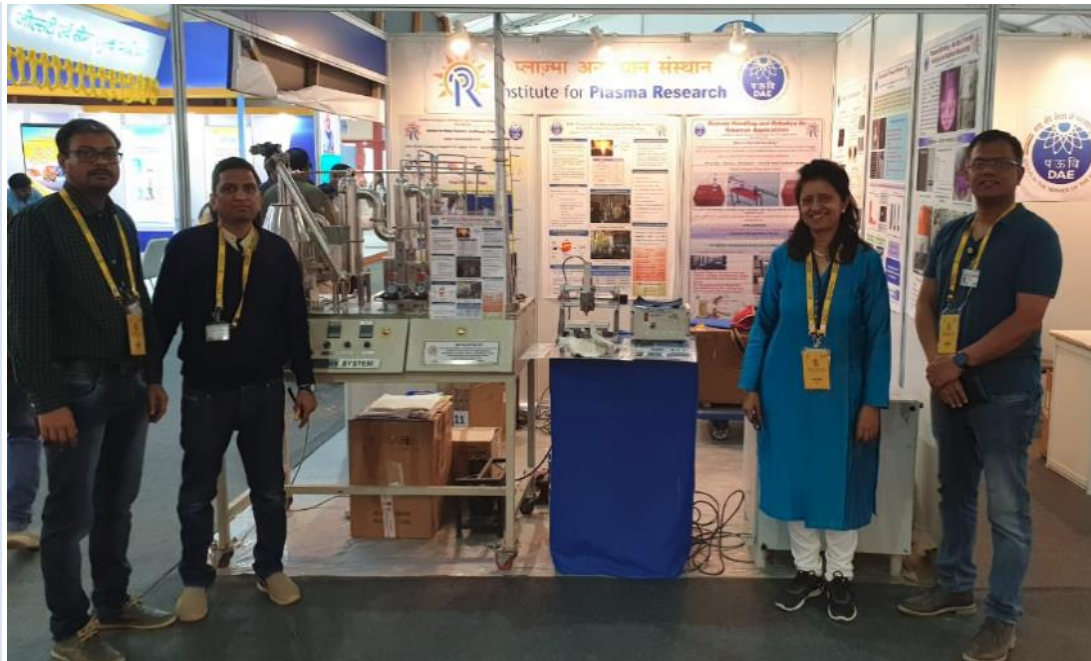


TF coils of SST-1 charged up to 8.4kA on 8-Jan-2019

IPR@ Pravasi Bharti Divas Exhibition

IPR participated in the 15th Pravasi Bharti Day exhibition under the DAE banner that was organized at Varanasi from 21-23 January, 2019. IPR's team consisted of Sutapa Ranjan, Ravi A V Kumar, Narendra Chauhan and Jignesh Chauhan. Both semi and fully working models of Pyrolysis, Nitriding, atmospheric plasma torch, medical plasma torch, hyper-redundant robotic arm as well as AI based X-Ray and Sputum Analysis software were displayed.

Prime Minister Shri Narendra Modi, Chief Minister of Uttar Pradesh, General V.K. Singh, MoS, MEA also visited the DAE stalls.



IPR's stall and team at the 15th Pravasi Bharti Divas exhibition



(L) Shri Jayant Khobragade, JS(ER) at IPR Stall (R) Some of the visitors at the IPR stall.

IPR Visits – Dec 2018-Jan 2019

Name Of the Institution	Date	Number of visitors
K. B. Institute of Pharmaceutical Education and Research, Kadi Sarva Vishwavidyalaya, Gandhinagar	21-Dec-2018	23 students and two Faculty members
Shree Adarsh B.Sc College , Botad , Gujarat	16-Dec-2018	27 B.Sc. Students and five faculty members
Tolani College Of Arts & Science Adipur, Kutch	23-Jan-2019	21 Students and 3 faculty members.



Students from Tolani College Of Arts & Science Adipur, Kutch during their visit to IPR



Students from Shree Adarsh B.Sc College, Botad, Gujarat during their visit to IPR

Atmospheric Plasma Division in IPR has designed and developed a unique plasma system for generating atmospheric pressure streamer free plasma in air using dielectric barrier discharge technique. This activity was financially supported by Department of Science and Technology (DST, New Delhi) and MANTRA (Man-Made Textiles Research Association), Surat.

This plasma system can remove the waxing from cotton without using any toxic chemical and water and hence, it is completely dry process. Plasma can generate highly active species which can provide the chemical reactions on the surface of the material and thus, improve the surface energy of the material which is conventionally done using huge quantity of water and chemicals in the textile industries. The plasma treatment is an environment friendly process because it doesn't use or generate any toxic chemical during the process.

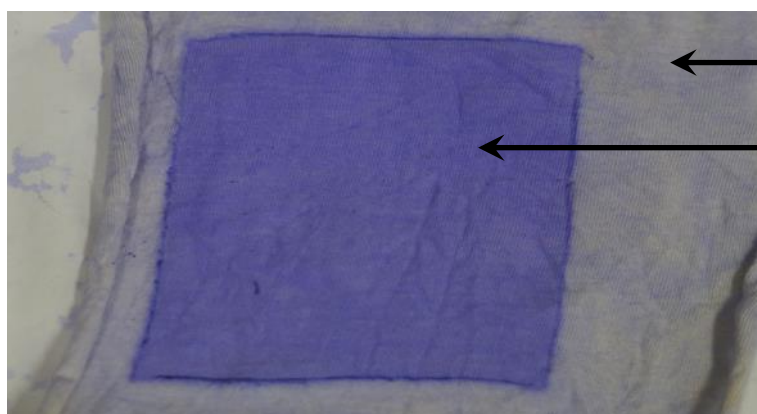
Since last 20-25 years, vast research has been conducted worldwide for generating such plasma, particularly in air. One of the major challenges observed in generating such plasma is to avoid streamer formation when using natural air. Hence, many industries in the world use helium or argon plasma in textile treatment which is very expensive and limited to high-end textile products. IPR has successfully developed generation of air plasma for inline treatment of textiles. The system was demonstrated to industries during the APTP (Applications of Plasma in Textile Processing) workshop in November 2018.

The generation of this plasma requires a unique power supply architecture which has been patented by IPR. The technology has also been transferred to one Mumbai based company on non-exclusive basis.

This system can treat 2.5 meter wide textiles (cotton, PET film, PP film *etc.*) at moderate speeds. There are multiple pairs of plasma discharges which number can be decided based on the type of material to be treated and the treatment speed requirement. Each plasma discharge is independently powered by the low cost power supply. This conventional water based scouring process generates cationic element on the surface, which help in absorption of the chemical dyes easily and efficiently. The plasma process along with the grafting of amino organic group on the surface would also generate the same cationic surface on textile which may become a complete solution for textile industries in future.



Plasma system developed by IPR for inline treatment of textiles



← Untreated area of grey cotton after dyeing

← Plasma treated area of grey cotton after dyeing

The functional improvement on the surface of the fabric can clearly be seen vis-à-vis the uptake of dye by the fabric after treatment with plasma. This can greatly reduce the quantity of dye as well as the water required for dyeing the fabric.



National Teachers Science Congress

14-16 Dec 2018 • AHMEDABAD

CERTIFICATE OF MERIT

Awarded to **Dr. Ravi A. V. Kumar** for his Oral presentation of paper titled **Impact of Awareness-cum-Training Programme for Science Teachers in Plasma and its Applications** at the 9th National Teachers Science Congress (NTSC), catalyzed and supported by National Council for Science & Technology Communication (NCSTC), Dept. of Science & Technology (DST), Govt. of India and organized by Vikram A Sarabhai Community Science Centre (VASCSC), during 14-16 December 2018 at Ahmedabad.

Pamposh Kumar
Dr. Pamposh Kumar
Director/Scientist F, NCSTC

Dilip Surkar
Dilip Surkar
Executive Director, VASCSC



Catalyzed & supported by:

Department of Science & Technology
Government of India



Implemented by:



IPR's scientific outreach programme "Awareness-cum-training programme in plasma science & technology and energy from fusion" which was conducted from April-July, 2018 and through which, over 250 high school and BSc Physics teachers were trained in basics of plasma and its applications was adjudged as one of the meritorious work presented at the 9th National Teachers Science Congress that was conducted by DST and NCSTC and organized by Vikram A Sarabhai Community Science Center, Ahmedabad during 14-16 December, 2018.

The oral presentation entitled "*Impact of awareness-cum-training programme for science teachers in plasma & its applications*" was made at the NTSC by Ravi A V Kumar on behalf of the Outreach team..



Mr. Rajiv Sharma of the SST-1 Cryogenic Division gave an oral presentation entitled "*Refurbishment of Liquid Nitrogen Phase Separators Hydraulics of 80 K Distribution System of SST-1*" at the 27th National Symposium on Cryogenics and Superconductivity at IIT Mumbai on 16 Jan 2019.

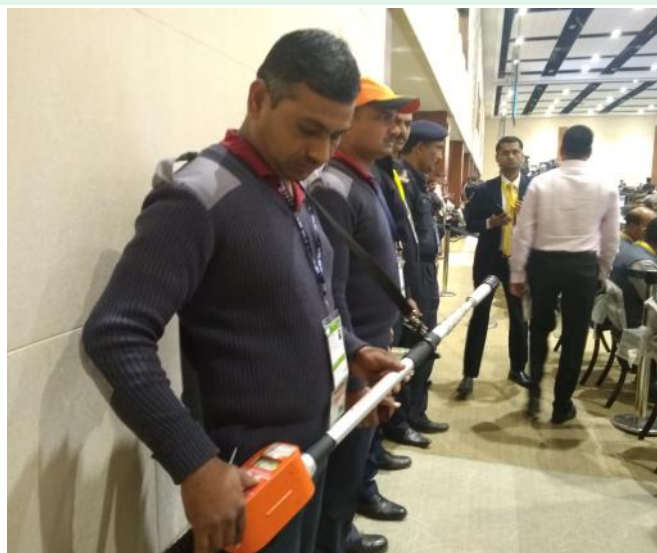
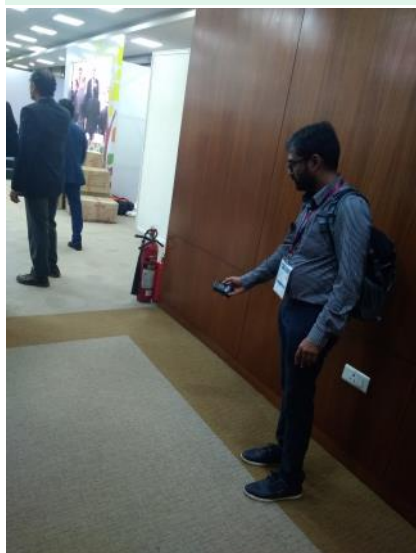
He also gave an oral presentation entitled "*Mitigation and In-house Repairing of Crucial Helium Leaks Joints in Cryogenic Systems of SST-1*" at the National Symposium on Vacuum Electronic Devices and Applications VEDA-2018 at IIT Guwahati on 23 November 2018.



Mr. Rohitkumar N. Panchal of the SST-1 Cryogenic Division gave an poster presentation entitled "*Automation of LN2 storage tanks of SST-1 cryogenic system*" at the 27th National Symposium on Cryogenics and Superconductivity at IIT Mumbai on 16 Jan 2019.

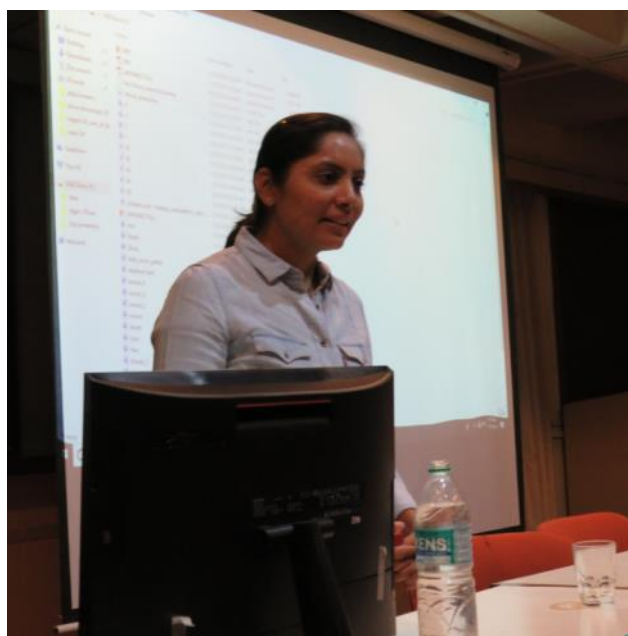
IPR Emergency Response Team @ Vibrant Gujarat

IPR's Emergency Response team was invited by the Government of Gujarat as an expert to monitor and handle any possible CBRN (Chemical, Biological, Radiological and Nuclear (CBRN) emergency during the 9th Vibrant Gujarat Global Summit at Mahatma Mandir, Gandhinagar during 18th to 20th January 2019. ERC-IPR being the 19th centre of DAE-ERC for detection and response to Nuclear/Radiological Emergencies in public domain in Gujarat, IPR's team consisting of Shri Sudhirsinh Vala, and Mr. Mitul R Abhangi from Neutronics Section and Shri Devendra Modi, Safety Officer IPR carried out the radiation surveillance prior to and during the Vibrant Gujarat-2019. These centres are able to provide technical support to respond to Nuclear and Radiological Emergencies anywhere in the country, including challenges from orphan radioactive sources and malicious acts using radioactive materials. The ERCs helps the nation in reducing the radiological consequences in case any such radiation emergency occurs anywhere in the country.



IPR CBRN team at Vibrant Gujarat 2019

संस्थान में 10 जनवरी, 2019 को विश्व हिंदी दिवस समारोह में संस्थान के स्टाफ सदस्यों ने उत्साह पूर्वक भाग लिया। इस अवसर पर आरंभ में सभा में उपस्थित सभी दर्शकों को विश्व हिंदी दिवस की महत्ता से अवगत कराया गया और इसके पश्चात् स्टाफ सदस्यों के लिए हिंदी प्रश्नोत्तरी प्रतियोगिता आयोजित की गई। हिंदी भाषा, राजभाषा नीति, हिंदी व्याकरण, पठुवि की गतिविधियों से ओतप्रोत प्रश्नों पर आधारित इस प्रतियोगिता में उपस्थित सदस्यों ने पूरे जोश के साथ भाग लिया। इस प्रतियोगिता के माध्यम से कर्मचारीगण कई नयी जानकारी से लाभान्वित हुए। इसके बाद राजभाषा कार्यान्वयन समिति द्वारा वक्तव्य का आयोजन किया। व्याख्यान के लिए अंतरिक्ष उपयोग केन्द्र, अहमदाबाद की वैज्ञानिक सुश्री पूर्वी जोशी को आमंत्रित किया गया। सुश्री पूर्वी जोशी 36वें अंटार्कटिका में भारतीय वैज्ञानिक अभियान (आईएसईए) का एक हिस्सा रह चुकी थी और उनके अंटार्कटिका के अनुभवों को साझा करने हेतु यह व्याख्यान रखा गया था, ताकि संस्थान के सदस्य भी अंटार्कटिका में भारतीय वैज्ञानिक अभियान से रूबरू हो सकें। राजभाषा कार्यान्वयन समिति के उपाध्यक्ष श्री राज सिंह ने सुश्री पूर्वी जोशी का संक्षिप्त परिचय दिया। सुश्री पूर्वी जोशी ने 'दक्षिणी सिरा - अंटार्कटिका की यात्रा' का विस्तार पूर्वक वर्णन किया और यात्रा के दौरान हुई कठिनाइयों पर भी चर्चा की और विडियो क्लिप के माध्यम से अपनी यात्रा का जीवंत चित्रण प्रस्तुत किया। अंत में निदेशक महोदय ने संस्थान की ओर से सुश्री पूर्वी जोशी को भेंट प्रस्तुत की। इसके बाद धन्यवाद ज्ञापन के साथ यह समारोह संपन्न हुआ।



Attendees of the 'Workshop on Basic Plasma Physics' organized by Assam Don Bosco University, Sonapur, visited CPP-IPR Laboratories and interacted with the scientists on 29th January, 2019.



New Parking @IPR

As per security regulations, parking of private vehicles at IPR has been moved outside the security gate with effect from 28th January 2019. The vehicles will now be parked along the two sides of the road leading to the campus from the main gate.



Upcoming Events

- ◆ 10th IAEA Technical Meeting on the Steady State Operation of Magnetic Fusion Devices (IAEA-TMSSO 2019), Hefei, China, 27-29 March 2019 <https://nucleus.iaea.org/sites/fusionportal/Pages/10th-TM-on-SSO-of-MFD.aspx>
- ◆ 11th International Symposium on Advanced Plasma Science and its Applications for Nitrides and Nanomaterials and 12th International Conference on Plasma-Nano Technology & Science, Nagoya, Japan, 17-21 March 2019 <http://www.isplasma.jp/index.html>

Past Events

- ◆ Dr. Partha Saikia, Institute of Physics, Santiago, Chile, gave a talk on "Experimental Study and Analytical Modeling of the Geometrically Asymmetric Dual Frequency Capacitively Coupled Plasmas" on 20th December 2018
- ◆ Dr. Kshama J Pansare, Institute for Plasma Research, Gandhinagar, gave a talk on "Cold atmospheric plasma in treatment of gingivobuccal squamous cell carcinoma and breast carcinoma: A proof of concept study" on 24th December 2018

- ◆ Dr. Prashant Sharma, ITER-India, Institute for Plasma Research, Gandhinagar, gave a talk on "Study of Defects Due to Ions Irradiation in Tungsten Foil by Transmission Electron Microscopy" on 21st December 2018
- ◆ Dr. Debjyoti Basu, Institute for Plasma Research, Gandhinagar, gave a talk on "Alternate method for RF-assisted current start up in SST-1" on 2nd January 2019
- ◆ Dr. Asha, ITER-India, Institute for Plasma Research, Gandhinagar, gave a talk on "Study of tungsten surface morphology under deuterium ion irradiation and its dependence on fluence" on 7th January 2019
- ◆ Dr. Prince Alex, Institute for Plasma Research, Gandhinagar, gave a talk on "Plasma Parameter Control using Multi-Grid Biasing System in a Double Plasma Device" on 10th January 2019
- ◆ Mr. Umesh Kumar, Institute for Plasma Research, Gandhinagar, gave a talk on "Effect of controlling toroidal field topology in a simple toroidal plasma: An experimental study" on 17th January 2019
- ◆ Dr. Ratan Kumar Bera, Institute for Plasma Research, Gandhinagar, gave a talk on "Excitation of wakefields and propagation of localized coherent structures in laser / beam-plasma systems" on 17th January 2019
- ◆ Prof. A. Ganguli, IIT Delhi, gave a talk on "Exploring possibility of using a Compact ECR Plasma Source for plasma thruster applications" on 18th January, 2019 (Colloquium # 294)
- ◆ Dr. Ritu Dey, Institute for Plasma Research, Gandhinagar, gave a talk on "Comprehensive analysis of ADITYA and ADITYA-U tokamak plasmas using DEGAS2 and UEDGE codes" on 22nd January 2019
- ◆ Mr. Sonu Yadav, Institute for Plasma Research, Gandhinagar, gave a talk on "Effect of In-homogeneous magnetic field on Helicon Antenna Produced Expanding Plasma" on 25th January 2019
- ◆ Mr. P. K. Atrey, Institute for Plasma Research, Gandhinagar, gave a talk on "Design and Development of Microwave Interferometer and Reflectometer Systems for Plasma Diagnostics in Tokamak" on 29th January 2019
- ◆ Ms. Pallavi Trivedi, Institute for Plasma Research, Gandhinagar, gave a talk on "Driven Phase Space Structures In A 1D Vlasov-Poisson Plasma" on 31st January 2019
- ◆ Dr. Sayantan Nath, Indian Institute of Information Technology, Allahabad, gave a talk on "Fire Protection in Coal Mine through Image Processing" on 28th January 2019
- ◆ Mr. Suman Aich, Institute for Plasma Research, Gandhinagar, gave a talk on "Estimation of Plasma Column Position by Mirnov Coil Measurements" on 30th January 2019
- ◆ Dr. Satyajit Chowdhury, Saha Institute of Nuclear Physics, Kolkata, gave a talk on "Experimental observation of Electron-Acoustic Wave Propagation In laboratory plasma" on 31st January 2019

Know Our Colleagues



Mr. Chetan Jariwala joined IPR in year 2001 as Scientist – SC at FCIPT. Presently he is working as Scientific Officer – F in the RF Plasma Application division. At FCIPT, he was initially involved in material characterization of various samples using X-ray Photoelectron Spectroscopy and Auger Electron Spectroscopy. Currently, he is engaged in development and processing activities of thin film depositions for solar cell applications by Plasma Enhanced CVD method. He is also involved in R&D of transparent conducting oxide films by Plasma Assisted Thermal Evaporation technique as part of development of materials related to fusion reactors, such as oxide nano-powders to develop ceramic windows for RF transmission applications, and fabrication of ceramic composites for flow channel inserts of the Test Blanket Module. He is also involved in R&D activities related to plasma applications in agricultural field, where he has started RF plasma treatment of various seeds such as wheat, pulses etc. for enhancement of germination and improvement of crop yield. He also routinely supervises B. Tech / M. Sc. / M. Tech students for their project work being done at IPR. His research interests include RF plasma applications in agricultural, novel applications of oxide nano-particles and composite applications for society.

Mr. Upendra Prasad joined IPR in 2002 as Scientist-SC in SST-1 magnets. He was involved in the development, prototyping and validation test experiments on new low resistance joints for SST-1 superconducting (SC) magnet winding packs and cryogenic sensor technology. He also had a major role in the refurbishment of TF and PF coils joints, insulation and associated components quality control for cryogenic testing, assembly with machine shell and commissioning activities. He was part of the team during fabrication, integration of new TR#1 coil and the initiation of first plasma in SST-1. He worked for task agreement on "detailing and finalizing the quality control items for ITER magnets procurement and assembly (ITA 11-103)" in 2007. As a member of fusion reactor design group, he contributed to the initial design studies of central solenoids (CS) and PF coils for future tokamak of IPR. Feb. 2017 onwards, he has been heading the magnet system division (MSD) including SST-1 magnets, new SC magnets for future tokamak and interdisciplinary SC magnets design, analysis, fabrication and testing. Currently, he is working as the head of MSD on physics and engineering aspects for the operation and maintenance of SST-1 magnets, design and development of high temperature and Nb₃Sn based SC magnets technologies for fusion future tokamaks and societal applications.



The IPR Newsletter Team

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