

Issue 042

January 2017

The Fourth State

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

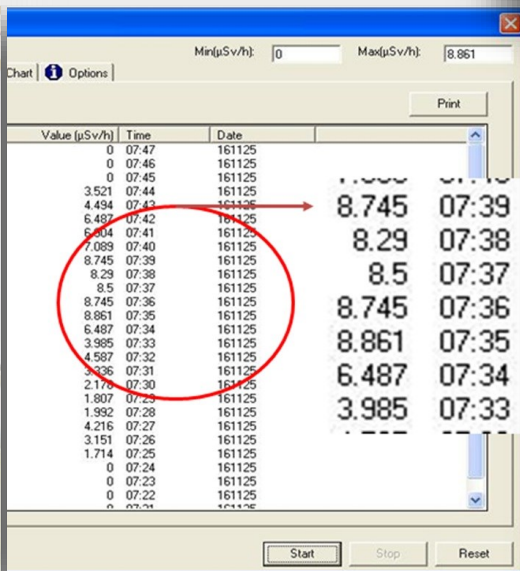
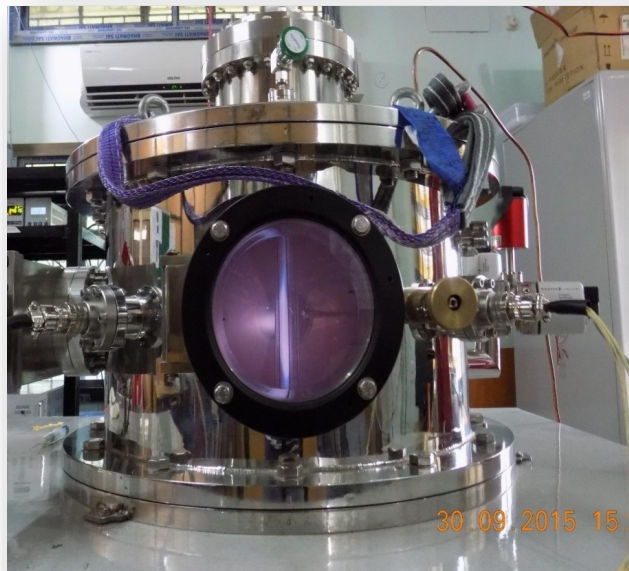
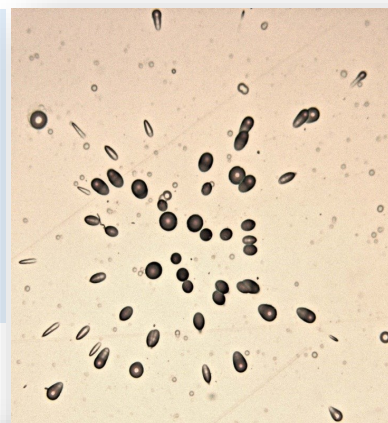
IPR Newsletter Wishes You All a Very Happy New Year !



CPP-IPR Inertial Electrostatic Confinement Fusion Device

India's maiden Inertial Electrostatic Confinement Fusion (IECF) device is currently under operation at CPP-IPR. The device mainly comprises of a concentric coaxial cylindrical grid assembly housed inside a cylindrical vacuum chamber, a gas injection system, a high voltage feed-through and a high voltage negative polarity power supply. On application of high negative potential of few tens of kV to the inner grid of the device, the deuterium ions overcome the coulomb barrier force and fuse together to produce neutrons of the order 10^8 n/s. At present, the device is being operated at input voltage range of -30kV to -60kV and the signature of DD neutrons emission has been noticed by employing neutron area monitor, bubble and nuclear track detectors.

(L-R anti-clockwise) : The IECF device showing glow discharge plasma ; Neutron area monitor showing dose rate @55 kV operation ; Photograph of bubble detector (a) before and (b) after exposure to neutrons ; Proton recoil tracks of neutrons as observed in CR-39



The 30th IPR Annual Day Celebrations "*Umang 2016*" was held at IPR main campus on 26th November 2016. The event, attended by more than 1500 participants, was inaugurated by IPR Director and members of the Staff Club. During the start of this event, a professional music band performed for the audience. This was followed by various musical and stage performances by IPR staff and their family members. A sumptuous dinner was arranged for all the participants. This was followed by traditional *Garba* with music performed by professional singers. Finally, the programme ended with live DJ music and dance. Prizes were also given away to young participants by Mrs. Pallavi Chaturvedi.



Images from the 30th IPR Annual day celebrations



Images from the 30th IPR Annual day celebrations

Sand Blasting (Abrasive blasting) is a general purpose technique to clean the surface or to roughen the smooth surface of various metallic materials such as tungsten, copper, steel, aluminum etc. Very fine (abrasive) bits of materials are made to strike at high velocity on the material surface to clean or etch the surface. Uniform surface is achieved after sand blasting on the material. Surface contamination seen in SS304 plate after Plasma cutting is cleaned using sand blasting machine at IPR within no time. Even hardest material such as tungsten material surface can be roughened. This medium size sand blasting machine works on induction – suction principle of abrasive delivery. This can be used for small and medium size jobs to clean the material surface and/or to roughen the surface.



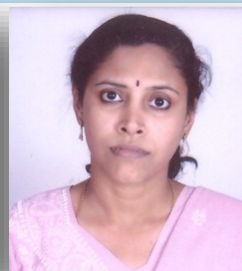
(L-R) : The sandblasting machine ; Copper (top) and tungsten (bottom) samples after sandblasting ; Plasma cut SS block before (top) and after (bottom) sand blasting.

IPR's Representation in PSSI



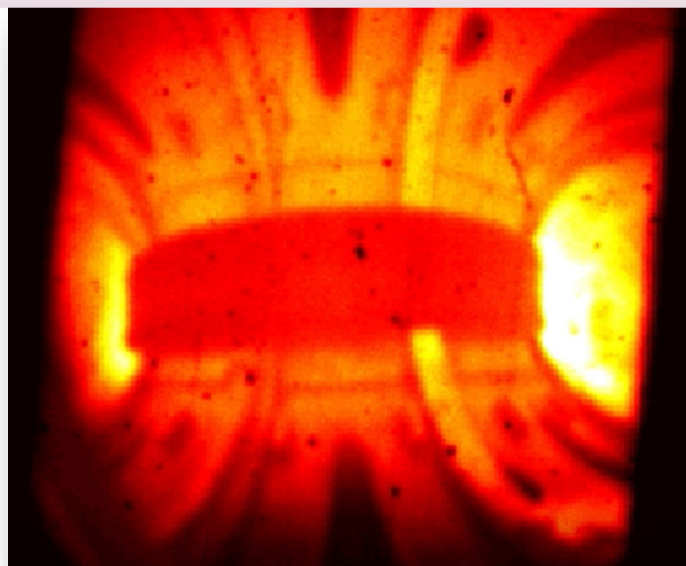
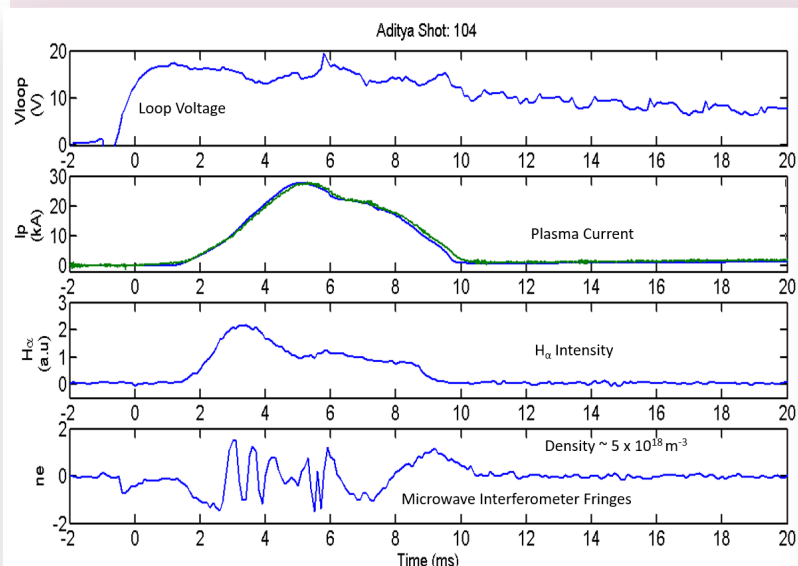
Professor Prabal K Chattopadhyay and **Ms. Chhaya Chavda** were elected to the posts of the President and General Secretary of the Executive Committee of the Plasma Science Society of India (PSSI) for the term 2017-19. **Ms. Supriya Nair** was re-elected unopposed as the Treasurer of PSSI for a second consecutive term.

(L) Prof Prabal Chattopadhyay (R) Ms. Chhaya Chavda and Ms. Supriya Nair



Aditya Upgrade - Update

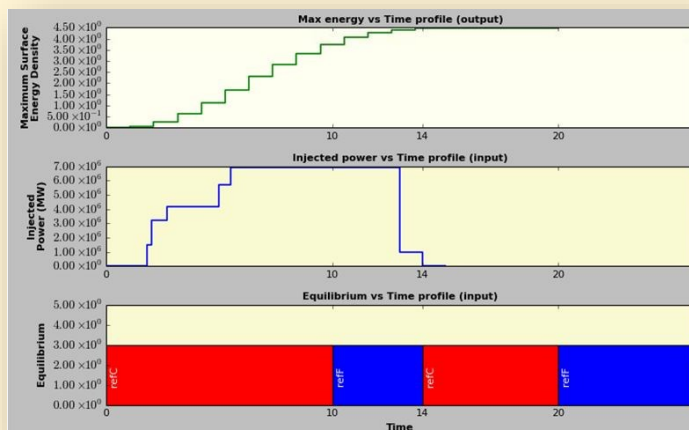
After installation of standard tokamak plasma diagnostics in ADITYA Upgrade along with their respective data acquisition systems, plasma discharges are initiated in Aditya Upgrade. With the application of $B_T \sim 1$ T, successful gas breakdown is obtained with ~ 20 V of loop voltage. Plasma currents, $I_p \sim 30$ kA with density $n_e \sim 5 \times 10^{18} \text{ m}^{-3}$ are obtained in preliminary discharges of Aditya Upgrade. Temporal evolution of loop voltage, plasma current, H_α intensity and microwave interference fringes of one representative discharge (shot#104) of Aditya Upgrade is shown in the image below. All the subsystem of the machine have performed as desired and the initial discharges are very satisfactory in terms of the functionality of the machine.



Shot No. 104 : (L) The typical parameters of shot# 104 (R) Image of the plasma glow captured by high-speed visible camera

Mr. Arvind M. Singh had been deputed from Computer Center, IPR to work in Tore-Supra WEST project "Wall Monitoring System (WMS)" from 13th June 2016 to 13th December 2016. He was working with Groupe Protection de la Première Paroi (GP3) at IRFM, CEA under the guidance of Dr. Jean-Marcel TRAVERE and CEA coordinator Dr. Philippe MOREAU. The name of his project title was "Participation on PLATo Integration into pre-pulse validation process during plasma operation". In the PLATo development, some of the tasks assigned to him were-

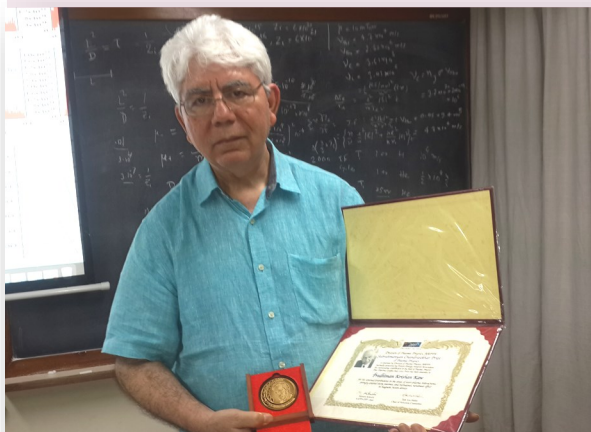
(1) To develop a python routine which can reconstructs the total power injected for waveforms with respect to time so as to compute the total heat load deposit for a given plasma reference scenario (interface with the WEST Pulse Schedule Editor Xedit). (2) To develop a python routine which can extract all magnetic equilibrium defined in a given plasma reference scenario for heat load map computation (interface with the WEST Pulse Schedule Editor Xedit). These codes are an offline tool that to be used during WEST plasma campaign which could predict the heat load deposit (actively cooled PFCs) or maximum energy (inertial PFCs) time evolution for a given plasma reference scenario.



Maximum energy time evolution in the PFC

Presentation of Chandrasekar Prize for Plasma Physics

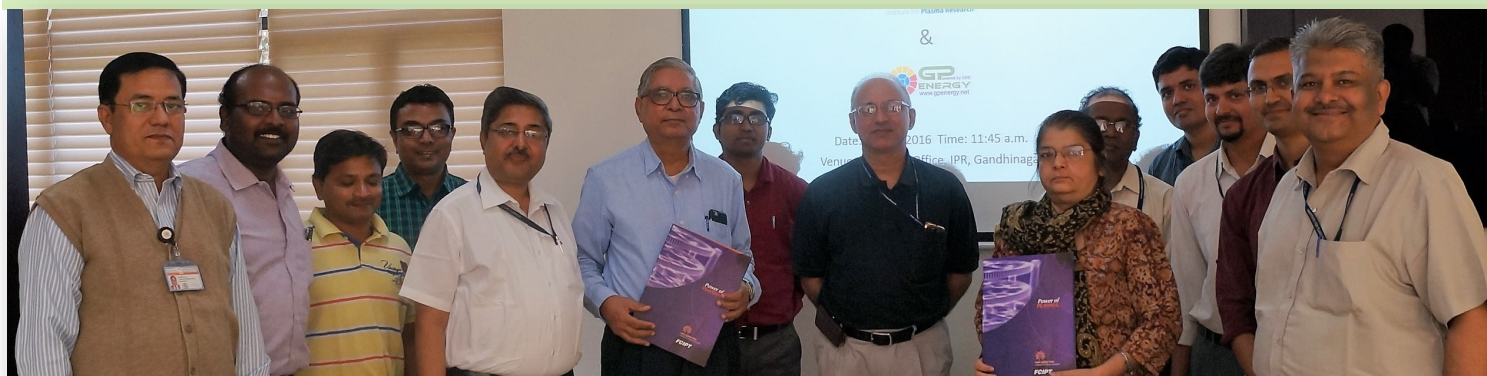
The S. Chandrasekhar Prize of Plasma Physics (for the years 2014, 2015, and 2016) were awarded in the ceremony that was held during the conference banquet of the 13th Asia Pacific Physics Conference (APPC-13) on 7th Dec 2016 at the Brisbane convention and exhibition centre, Australia. AIP president Warrick Cauch and Prof. M. Kikuchi presented the medals. The 2015 medal for the S. Chandrasekhar award was presented to Prof. P. Kaw. Since Prof Kaw could not attend the ceremony, the award was received on his behalf by Dr. Mukesh Ranjan. Prof. Kaw, In his recorded message said "Dear colleagues, I am grateful to all my teachers for showing me how to do new things, to my students and research buddies for providing me the support and patience necessary to complete the investigations and to my peers for appreciating the work I have done". Our congratulations once again to Prof Kaw for his award. The medals for the years 2014, 2015 and 2016 were given to AAPPS-DPS by IPR and was designed by Ravi A V Kumar.



(L) Prof P K Kaw with the Chandrasekar Prize and the citation. (R) The medal (front and back)

Technology Transfer

A non-exclusive technology transfer agreement was signed by and between the Institute for Plasma Research (IPR) and M/s G P Green Energy Systems Pvt. Ltd., (GPGESPL) Kolkata for plasma pyrolysis technology for disposal of organic waste (non-biomedical) on 7th Dec, 2016 at Director's Office, IPR, Bhat Gandhinagar. The agreement was signed by Prof. Amita Das, Dean - IPR and Shri J. Jangada, Technical Director, GPGESPL in the presence of Director - IPR and other members of IPR & GPGESPL. M/s G P Green Energy Systems Pvt. Ltd. is a waste-to-energy equipment manufacturing company and is into the business of gasification with an equity partnership from Güssing Renewable Energy GmbH, Austria. The company intends to utilize plasma pyrolysis technology for various waste-to-energy projects and address the environmental demands growing under "Swatchh Bharat" campaign of Government of India. This tech transfer is a step further to enable dissemination of plasma pyrolysis technology for the society.



The work on the laboratory and auxiliary buildings are progressing and the main metal structure of the laboratory building is nearing completion. The auxiliary building structure and roof have been completed and the flooring is currently under construction. The pump house structural work and waterproofing have also been completed.



(L) Top view of the laboratory building (R) Auxiliary building flooring work in progress



(L) The pump house (R) Top view of the auxiliary building.

IPR Data Center

The IPR Data Center (DC) is nearing completion of its Phase-1. This phase will have 5 server racks and 2 network racks. Once this is completed, all the essential services (E-office, web, email, HPC etc.) will be migrated from their current locations on to these racks. These state-of-the-art racks have very efficient in-rack cooling system. The DC will also have UPS based power which will backed up by a diesel generator, thus providing 24x7 power and cooling to IPR's major IT resources. Work on the Phase 2 of the DC will start soon after all the migration is completed. The second phase will see the installation of more 5 server racks and 2 network racks. Phase 2 will be used to house IPR's future HPC systems.



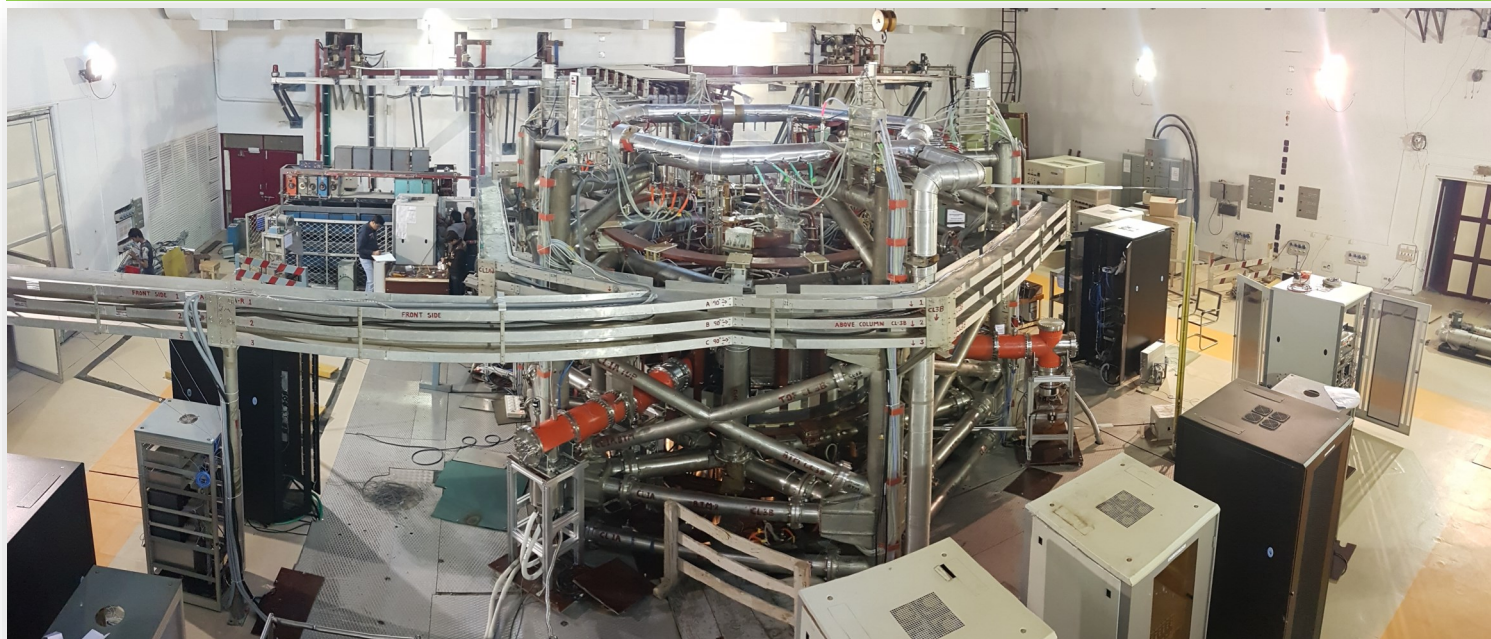
(L) The IPR Data Center (Phase-1) in the final stages of completion. (R) The cooling system for the DC being installed.

Aditya Vacuum Division has been responsible for achieving and maintaining clean vacuum for the high temperature plasma experiments in Aditya Tokamak. This was realized through the continuous running of the UHV system developed by this group. The system also include the controlled gas feed, wall conditioning using automated glow / pulse / ECR discharges and wall lithiumization. This division also conducts independent experiments on these aspects of UHV and vessel maintenance and is also involved in mainstream Tokamak experiments. They have had a major role to play in the ongoing upgradation of Aditya with the design and development of new ultra-high vacuum vessel, limiter, diverter and baking systems, all of which have been successfully designed, procured, tested and installed on Aditya.

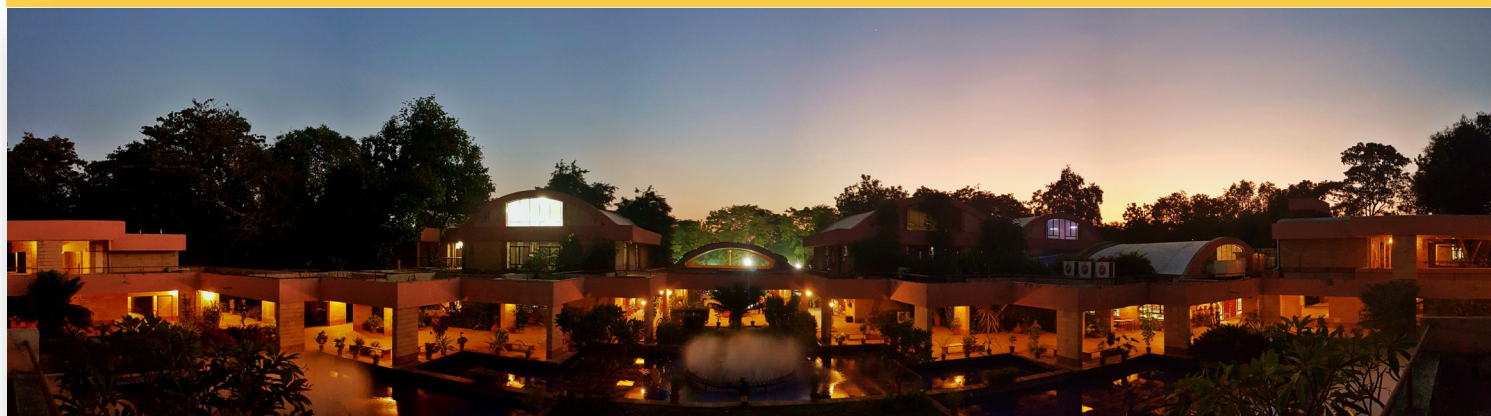


Members of the Aditya Vacuum Division (L-R) : Parmar, Kulav Rathod, Kaushik Acharya, Nilesh Patel, S.B Bhatt, Kaushal Patel and Kumarpalsinh Jadeja.

Panoramic View of Aditya-U



IPR-Twilight View



Twilight view of IPR. Click [here](#) and [here](#) for 360 Degree images of IPR building

- ♦ **Mr. Soumen Ghosh**, Institute for Plasma Research, Gandhinagar, gave a talk on "On first observation of multiple current free potential structures in HeX device at IPR" on 30th November 2016
- ♦ **Mr. Meghraj Sengupta**, Institute for Plasma Research, Gandhinagar, gave a talk on "Studies in Non-Neutral Plasmas using Particle-in-Cell Simulations" on 2nd December 2016
- ♦ **Ms. Deepa Verma**, Institute for Plasma Research, Gandhinagar, gave a talk on "The Study of Localized Solutions in Laser-Plasma System" on 5th December 2016
- ♦ **Dr. Ravi B. Grover**, Homi Bhabha National Institute, Mumbai, gave a talk on "The Journey Leading to India Joining ITER" on 9th December 2016
- ♦ **Prof. James Bradley**, Department of Electrical Engineering and Electronics, University of Liverpool, UK, gave a talk on "Plasma discharges for the ambient processing and detection of materials" on 14th December 2016
- ♦ **Mr. Samirsinh Chauhan**, Institute for Plasma Research, Gandhinagar, gave a talk on "Studies of magnetically constricted anode plasma source" on 16th December 2016

Upcoming Events

- ♦ 19th Israeli Conference on Plasma Science, Jerusalem, Israel, 5 February 2017 <https://scholars.huji.ac.il/plasma>
- ♦ European Winter Conference on Plasma Spectroscopy, Austria, 19-24 February 2017 <http://www.ewcps2017.at/>
- ♦ Optical Biomimetics, Imperial College London, UK, 22 February 2017 <http://www.iop.org/events/scientific/conferences/calendar/#/?i=1>
- ♦ IEEE Power and Energy Conference at Illinois (PECI-2017), Champaign, IL, United States, 23-24 February 2017 <http://peci.ece.illinois.edu/>
- ♦ 2017 Joint ICTP-IAEA School on Atomic Processes in Plasmas, Trieste, Italy, 27 February-3 March 2017 <https://www-amdis.iaea.org/Workshops/ICTP2017/>
- ♦ National Science Day Celebration at IPR. 7-8 January, 2017

Congratulations !



Prof. Subroto Mukherjee, Associate Dean (Academic) and Head, FCIPT has been elected as a Fellow by the Gujarat Science Academy (GSC).

Mr. Kedar Bhope, Scientist SD of Divertor & First-wall Technology Development Division has been selected to receive the ISNT-Eastwest Best Paper Award (Industrial Applications), instituted by the Indian Society for Non-destructive Testing for the year 2016 for the paper entitled "Ultrasonic inspection of HHF tested tungsten monoblock type diverter test mock ups".



Know Our Colleagues



Mr. Jaydipsinh K. Gohil, joined the Institute in 1997 in the Civil Maintenance Group. The three member group he is associated with takes care of civil maintenance and campus development related activities at IPR, IPR-hostel and Guest house, FCIPT, ITER India, IPR laboratory Extension building and also Ruswi Park quarters of the Institute spanning a total of 45000 Sqm area now. His works include functions related with public health and environment protection (EPRJ), additions, alteration and renovation works on the existing buildings and routine and special repairs. Group also manages casual labour requirements of the Institute, special function and events and other timely responsibilities and maintains the aesthetic and visual appeal of the buildings and premises.

Mr. Sunil Dani joined IPR in 1997 in ICRH of RF Division and contributed to the design and development of most of the components of the ICRH 6" and 9" Rigid Coaxial Transmission lines and also in its installation and commissioning from RF lab to Aditya and SST-1. He was involved in the commissioning of Klystron at RF lab and Gyrotron at Aditya and participated in various operations in the RF power delivery to Aditya and SST-1. He was deputed to ITER Organization in 2009 in the vessel division where he was involved in the design of IWS blocks and in checking the 2D Engineering drawings and 3D models of the same. He also contributed in the design of Vacuum Vessel sectors and prepared technical specifications for the EUDA procurement arrangement. He was in charge of technical documentation prepared by KODA, EUDA for VV sectors, RFDA for upper ports and INDA for IWS for the review and Approval by IO. On his return in 2014 he joined ITER-INDIA and is currently working in the IWS group as Dy. Technical responsible officer (TRO) in the manufacturing, monitoring and follow up of IWS blocks and fasteners at ATL Bangalore and UPS Rohtak.



The IPR Newsletter Team

Ritesh Srivastava	Tejas Parekh	Ravi A. V. Kumar	Priyanka Patel	Dharmesh P	Mohandas K.K.
Suryakant Gupta	Ramasubramanian N.	Chhaya Chavda	Shravan Kumar	Supriya N	Ritesh Sugandhi