

MoU Signed Between IPR and SAC

A Memorandum of Understanding (MoU) on joint technology sharing and capacity building of scientists and engineers working in the two institutions was signed between IPR and Space Application Center (SAC) on 01 Sept. 2017 at SAC, Ahmedabad. The signatories to the MoU were Director IPR, Dr. Shashank Chaturvedi and Director SAC, Shri Tapan Misra. The event was also attended by representatives of both IPR and SAC.

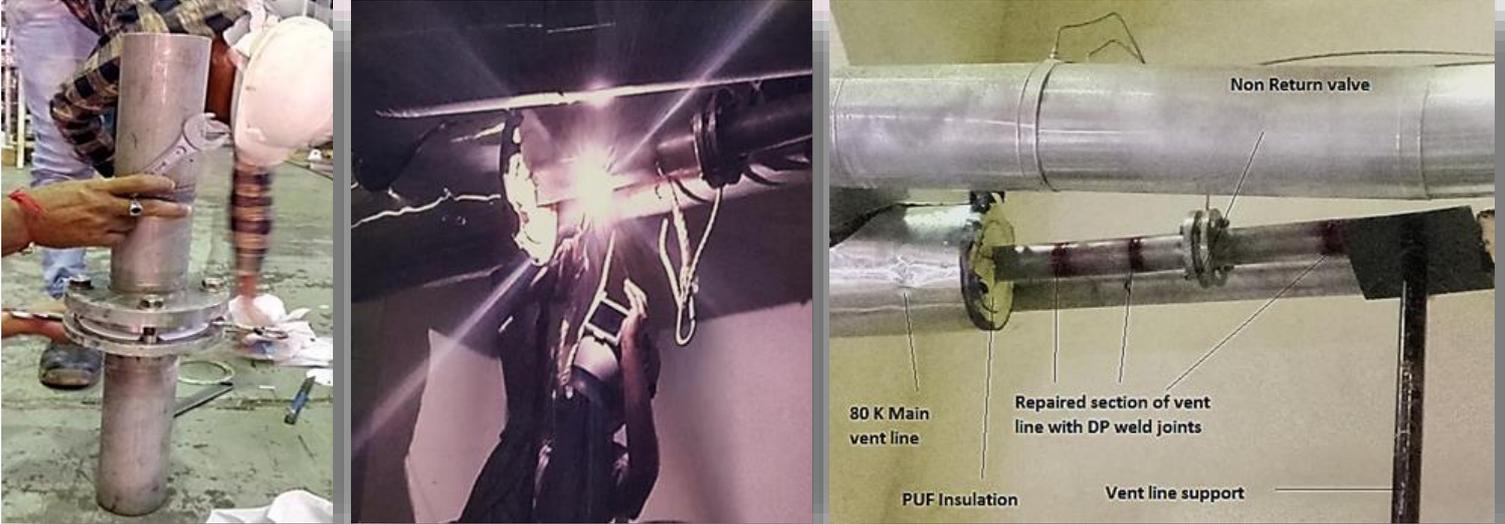
The scope of MoU include mutual co-operation between IPR & SAC for following topics ;

- ◆ Development of LN₂ cooled Sorption Cryo pumps for small and medium sized thermovac chambers.
- ◆ Development of LN₂ cooled calibration targets for Earth Observation (EO) missions.
- ◆ Mutually utilize various technologies developed by IPR & SAC.
- ◆ Development of suitable plasma coating, low out-gassing and contamination free metallic black surface on base materials like Invar and Aluminum for EO missions.
- ◆ Active and passive components related to RF and microwave systems.
- ◆ Power electronic systems like AC-DC/ DC-DC converters.



Images from the signing of MoU between IPR and SAC held at SAC, Ahmedabad.

During the operation of 80 K system, in the main vent line, heavy frosting and dripping of LN₂ fluid was observed. In-house repairing task of 80 K vent line has been carried out safely and successfully. The 3" SS line cut from the section of 2 meter by removing of installed PUF insulation. The leak locations were identified in the Nitrile Butadiene rubber (NBR) o-rings of the non-return valve's (NRV) at both seal surfaces of 150 ANSI flanges. In-house developed PTFE gasket and Indium seals were fabricated and installed on the NRV flanges. The seal assembly with pipe section were tested in the lab with the achieved acceptable helium leak tightness of $< 10^{-8}$ mbar-l/s. The new pipe section along with NRV assembly were then installed, faced, aligned and successfully tested for dye penetration tested TIG welded at leaked location. The criticality of the repairing task is that all activities to repaired the line has been carried out using a crane at a height of 12 meters within the complex piping network. In the congested space available, controlling the welding temperature to prevent burning of bitumen adhesive was specially taken care of during the repair work.



(Left) Fitting of PTFE and Indium seal in the NRV (Center) Welding the main LN₂ vent line (Right) The repaired 80 K vent line

Prototype Diagnostic System Installed @ ITER India Lab

As part of its contributions to ITER diagnostics, ITER-India will be contributing several sub-systems of electron cyclotron emission (ECE) diagnostic systems, designed to measure local electron temperature with high spatial and temporal resolution. One of these—a Fourier Transform Spectrometer—will be used in particular to measure the power loss from the ITER plasma due to ECE radiation and to study the non-thermal electrons in the plasma. A prototype of the fast-scanning Fourier Transform Spectrometer (FTS), based on requirements specified by ITER-India, was manufactured by Blue Sky Spectroscopy Inc., Canada. This FTS has been installed in the ITER-India laboratory where post-installation acceptance tests have been carried out and found satisfactory. Based on a polarizing Michelson interferometer (70-1000 GHz), this fast-scanning Fourier Transform Spectrometer also consists of a cryo-cooled, dual-channel Tera-Hertz radiation measurement detector system. Experiments will be carried out to test attenuation in transmission line components; the results obtained will be instrumental in providing input for the design of an ultra-wideband (70-1000 GHz) transmission line for the ITER ECE diagnostic system.



Prototype Fourier Transform Spectrometer at the ITER India lab.

Plasma nitriding is a surface hardening process done on precision mechanisms elements undergoing relative motion, in order to enhance their life, reduce wear and to ensure stringent performance quality throughout their life. The spacecraft mechanisms, like Solar Array Drive Mechanisms, utilize gear systems to transform and transmit motion. As these components need to perform their intended operation without degradation, they need to be wear resistant during their entire life cycle. Considering the mission requirements from these spacecraft systems, it was realized that, plasma nitriding process could be used for their surface hardening. FCIPT is now providing service to get the gears plasma nitrided. The typical components that are nitrided using this facility are: spur gears, motor shaft, gear shaft, ring, sun, planet and outer gears. Considering the increased demand on the quantity of components to meet the enhanced mission needs, it was realized to establish a plasma nitriding facility at IISU. The space quality plasma nitriding system was built for IISU as per the specifications laid down by them. The pre-dispatch of the system has been carried out by engineers from IISU, and the system is ready to be dispatched for installation and commissioning at the ISRO Inertial Systems Unit (IISU), Trivandrum. The plasma nitriding team : Dr. Alphonsa Joseph, Mr. Ghanshyam Jhala, Mr. Akshay Vaid, Mr. Naresh Vaghlea, Mrs. Keena Kalaria, Mr. Chirayu Patil, Dr. Suryakant Gupta, Mr. Vijay Chauhan and Dr. S. Mukherjee.



Plasma Nitriding system developed by FCIPT for IISU, Trivandrum

CPP-IPR News

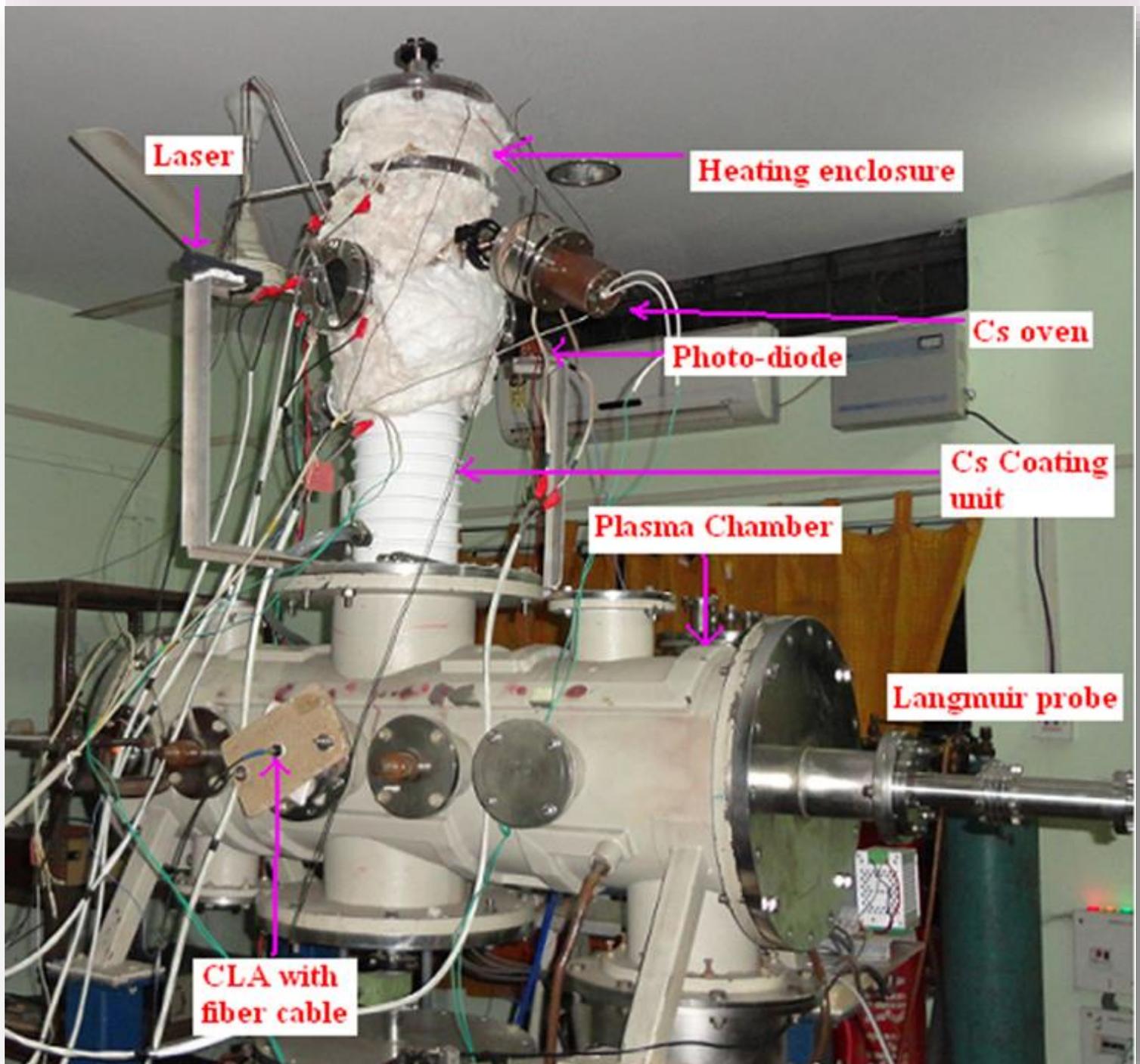


Group photo of the CPP-IPR Staff members : (L-R) Dr. T.K. Borthakur (Sci.-SE), Mr. P. Barua (Off. Clerk-B), Dr. N.K. Neog (Sci.-SD), Mr. P.K. Deka (Asstt. Acc. Off.-I), Dr. B.J. Saikia (Sci.-SF), Mr. S. Sarma (Off. Asstt.-C), Dr. P.J. Bhuyan (Sci.-SC), Dr. S.R. Mohanty (Assoc. Prof-II), Mr. A. Bujarbaruah (Off. Asstt.-A), Dr. M. Dey (Sci.-SF), Mr. H. Sarma (Off. Asstt.-A), Prof. K.S. Goswami (Centre Director), Mr. J. Goswami (Off. Clerk-B), Dr. B.K. Saikia (Assoc. Prof-II), Mr. C.K. Sarma (Off. Clerk-B), Dr. S.S. Kausik (Sci.-SD), Mr. H.C. Hazarika (Eng.-SD), Mr. A. Baishya (Eng.-SD), Mr. M. Haloi (Attnd.-B), Mr. D. Kalita (Driver), Mr. H. Kalita (Tech. Asstt.-B), Mrs. T. Deka (Off. Asstt.-A). Absent in the photograph: Dr. M. Kakati (Assoc. Prof-I), Dr. M. Chakraborty (Sci.-SD), Mrs. D. Kalita (Admin. Off.-I), Mr. G.D. Sarma (Trades.-B), Mr. M.K.D. Sarma (Trades.-B), Mr. K. Deka (Trades.-B).

A Novel Surface Assisted Volume Negative Hydrogen Ion Source @ CPP-IPR

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A revolutionary technique has been developed at CPP-IPR, in collaboration with IPR, Gandhinagar for production of negative hydrogen ions. Negative hydrogen ions have a wide variety of significant applications in fusion plasma devices, particle accelerators, surface modifications and biomedical fields. Negative hydrogen ion based neutral beam injector is a critical heating and current drive system in a fusion reactor. However, the present negative ion configuration has limitations in terms of production, extraction, cesium inventory and management. To overcome these limitations, a proof-of-principle experiment based on a novel concept regarding surface assisted volume negative ions production by sprinkling cesium coated tungsten dust grains (low work function surface) into a hydrogen plasma has been carried out at CPP-IPR. Four different diagnostics have been used to validate the concept. The measured negative hydrogen ion fraction with respect to the plasma density for different discharge conditions varies from ~ 0.2 to 0.3 in presence of cesium coated tungsten dust particles. The experimental results show good agreement with the theoretical estimations. The ion source is floated negatively with respect to the extraction chamber with a potential difference of 30 kV DC total. Taking into account the high voltage in the experimental system during the beam extraction, the design of remotely operated data acquisition and control system with fiber optic isolation module having ~ 150 channels has been completed. The advantage of the present technique is that the probability of cesium pollution and high cesium consumption within accelerator stages is negligible. As the negative hydrogen ions are produced almost uniformly around the dust column in the plasma volume, thus the negative hydrogen ions are coming out from the dust surface isotropically and fill the plasma volume. As a result, it is not required to reverse the direction of negative hydrogen ions for extraction. As the micron sized cesium coated tungsten dust are used as low work function surface for negative hydrogen ion production, the present source has an advantage to improve the ratio of low work function surface area to plasma volume further by changing the dust density without changing the plasma setup geometry which will help to develop a compact efficient ion source in future. This device has also been patented by the group. Those who have been involved in this work are B. Kakati, S.S. Kausik and B.K. Saikia from CPP-IPR and M. Bandyopadhyay and P.K. Kaw from IPR, Gandhinagar.



The photograph of the experimental setup of the Negative Hydrogen Ion Source at CPP-IPR

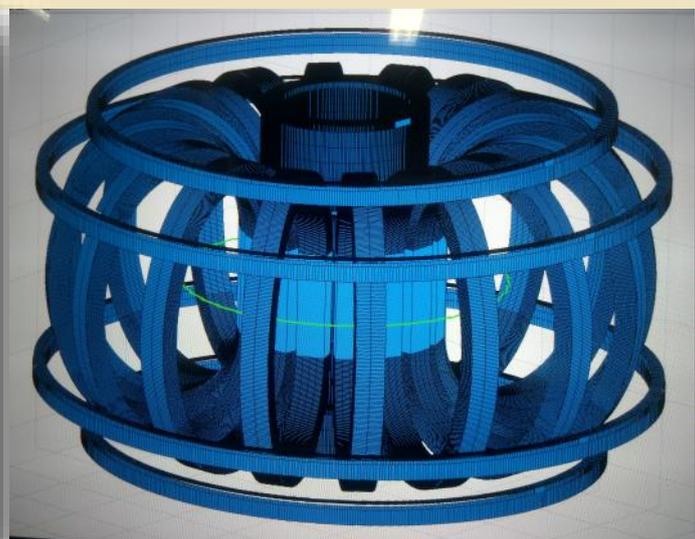
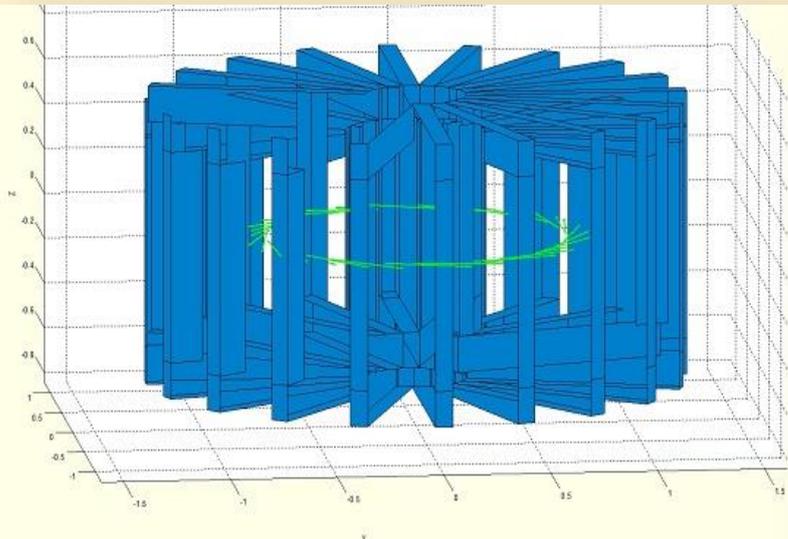
The Diagnostic Neutral Beam (DNB) group is responsible for the realization of a complete 'Negative ion based neutral beam injector' (NNBI) system for ITER Helium ash content diagnosis in the Deuterium-Tritium (D-T) phase of the operation using charge exchange recombination spectroscopy (CXRS). This complex system, the group mandated to build, consists of many functional components like the large size vacuum vessel of size 5m x 5m x 9m, 8-driver RF based inductively coupled Negative Ion Source fitted with 100kV ion accelerator for 60A ion beam, Neutraliser, Residual Ion Dump to filter out un-neutralized ions, Calorimeter for beam diagnostics, Fast Shutter, Absolute Valve, Duct linear, Passive Magnetic Shield, Exit Scraper, Active Correction and Compensation Coil (ACCC) and High Voltage Bushing (HVB). Also the Group is extensively involved in meeting with ITER interface requirements; integrating the design with ITER database through ENOVIA platform, understanding and implementing the requirements of nuclear codes, SDC-IC / RCC-MR / MPH / IVH, compliance with respect to French quality order and INB orders from the phase of design to delivery, Remote handling compatibility, handling of Safety Important Class / Protection Important Class components, quality assurance, finite element analysis for structural / thermo-hydraulic / fatigue / seismic, CFD, bellow design, quality control and inspections. Along with the domestic negative neutral beam program and ITER deliverable, group is also contributing to Neutral Beam Test Facility (NBTF), Padova in terms of providing agreed hardware components (i.e SPIDER Beam Dump), exchanging the experimentation results and manufacturing feasibility / results / accuracy for precision components.



Standing (L-R) G. Roopesh, Manas Bhuyan, Ratnakar Yadav, Vishnudev MN, Ashish Yadav, Hitesh Patel, Dhananjay Singh, Venkat Nagaraju, Himanshu Tyagi, Jignesh Bhagora, Jaydeep Joshi, Kaushal Joshi, Deepak Parmar, Milind Patel, Hardik Shasangiya, Suraj Pillai. **Sitting (L-R)** : Sejal Shah, C Rotti, Arun Chakraborty, Mainak Bandyopadhyay

MatLab Code for Magnetic Field Calculations

Electromagnets are used to generate magnetic fields of arbitrary shapes in tokamaks, spheromaks and other fusion type machines. The design of electromagnets for complicated magnetic fields require a code for generating suitable shaped and sized electromagnets. Existing tokamaks and future machines with electromagnets' design require an easy user friendly, Windows based, in-house customizable code. This MatLab code was designed and developed with easy EXCEL based input parameters of electromagnets in Cartesian or Polar coordinates, dimensions of electromagnet elements, space of interest of magnetic field in either coordinates and EXCEL/txt format magnetic field data and plots depicting electromagnets and magnetic field,. The code was validated using standard examples and applications to various electromagnet systems in IPR.



(Left) Aditya-U TF coil system. (Right) SST-1 TF and PF coil systems

संस्थान में हिन्दी दिवस के उपलक्ष में 1 सितम्बर से 15 सितम्बर तक हिन्दी पखवाड़ा समारोह का आयोजन किया गया। पखवाड़े के दौरान विभिन्न नारा लेखन, निबन्ध लेखन, चित्र देखो कहानी लिखो, सुलेखन, वैज्ञानिकी/तकनीकी एवं प्रशासनिक लेखन, समाचार पत्र वाचन, अनुवाद, पोस्टर, चाय पर चर्चा, हिन्दी प्रश्नोत्तरी, कहानी वाचन, वाद-विवाद, विडियो क्लिप-हिन्दी में रिपोर्टिंग, तात्कालिक भाषण एवं कविता-पाठ - प्रतियोगिताओं का आयोजन किया गया जिसमें सभी स्टाफ सदस्यों ने अत्यधिक उत्साह से भाग लिया। 4 सितम्बर को 'हिन्दी कार्यशाला' में श्री हरीशचन्द्र खण्डूरी, सहायक प्रशासनिक अधिकारी ने कर्मचारियों को हिन्दी व्याकरण, बोलचाल की स्पष्ट हिन्दी, हिन्दी में कार्यालयीन पत्राचार से संबंधित प्रशिक्षण दिया। चाय पर चर्चा में 'क्या भारत विज्ञान एवं तकनीकी के क्षेत्र में दुनिया का अग्रणी देश बन सकता है? यदि हाँ, तो कैसे ?' विषय पर प्रतिभागियों द्वारा कई तर्क एवं विचार प्रस्तुत किये गये। वाद-विवाद प्रतियोगिता में 'क्या माता-पिता द्वारा बच्चों को गैज़ेट्स/इंटरनेट की सुविधा देना उचित है?' - विषय पर पक्ष एवं विपक्ष में विचार प्रस्तुत किये गये। 14 सितम्बर, हिन्दी दिवस के उपलक्ष्य में पुस्तकालय अनुभाग द्वारा हिन्दी साहित्य की चुनिंदा पुस्तकों का प्रदर्शन किया गया।

समापन समारोह में कार्यकारी मुख्य प्रशासनिक अधिकारी एवं राभाकास के सदस्य श्री प्रवीण कुमार आत्रेय ने गृह मंत्री एवं परमाणु ऊर्जा विभाग के सचिव के संदेश का वाचन कर संस्थान में राजभाषा के सुचारु रूप से कार्यान्वयन हेतु स्टाफ सदस्यों को प्रेरित किया। निदेशक महोदय डॉ. शशांक चतुर्वेदी ने सभी विजेताओं को बधाई देते हुए संस्थान में चल रही वैज्ञानिकी गतिविधियों को हिन्दी में व्यापक रूप से उद्घासित करने की प्रेरणा दी। निदेशक महोदय ने संस्थान में शुरू की गई अंतर-अनुभागीय चल राजभाषा शील्ड योजना के अंतर्गत राजभाषा में श्रेष्ठ कार्य हेतु संस्थान के पुस्तकालय अनुभाग को इस शील्ड से सम्मानित किया एवं राजभाषा में उत्कृष्ट कार्य करने के लिए श्री हरीशचन्द्र खण्डूरी, सहायक प्रशासनिक अधिकारी एवं सुश्री प्रतिभा गुप्ता, इंजीनियर एसएफ को वर्ष 2016-17 का राजभाषा पुरस्कार प्रदान किया। साथ ही हिन्दी परीक्षा एवं हिन्दी टंकण परीक्षा उत्तीर्ण करने वाले स्टाफ सदस्यों को प्रमाण-पत्र वितरित किये और बाद में हिन्दी पखवाड़ा समारोह के सभी विजेताओं को पुरस्कृत किया गया। अंत में श्रीमती संध्या पी दवे ने हिन्दी पखवाड़ा समारोह को सफल बनाने हेतु सभी को धन्यवाद दिया।



हिन्दी पखवाड़ा समारोह की कुछ तस्वीरें

Various sports tournament are currently being organized by the Staff Club for IPR staff. These include table tennis, carom, chess, badminton, volleyball, football and cricket. A total of 157 registrations have been received by the staff club for these tournaments. Many The table tennis, carom and chess tournaments which are conducted after office hours at IPR and will continue till the end of September.

There are 26 registered participating teams for the first round games while 84 IPR staff played individual matches for carom, table tennis and chess. During the next month, tournaments for volleyball, badminton, cricket and football will be also be played.



Images from the ongoing tournaments of chess, table tennis and carom.

Upcoming Events

- ◆ Topical Research Meeting on the Physics Driving Innovation Across the Nuclear Industry, Manchester Victoria and Albert Hotel, Manchester, UK, 1-2 November 2017 <http://pin2017.iopconfs.org>
- ◆ 2nd International Conference on Extreme Light (ICEL), Szeged, Hungary, 5-9 November 2017 <https://www.eli-alps.hu/indico/event/12/>
- ◆ 18th International Conference on Fusion Reactor Materials (ICFRM- 18), Aomori Japan, 05-10 November 2017 <http://www.icfrm-18.com/index.html>
- ◆ 70th Annual Gaseous Electronics Conference, Pittsburgh, Pennsylvania USA, 6-10 November 2017 <http://www.apsgec.org/gec2017/>
- ◆ 32nd National Symposium on Plasma Science & Technology (Plasma-2017), Institute for Plasma Research, Gandhinagar, India, 07-10 November 2017 <http://www.ipr.res.in/plasma-2017/>
- ◆ 5th International Conference on Plasma Chemistry and Plasma Processing, Paris, France, 13-14 November 2017 <http://plasmachemistry.alliedacademies.com/>
- ◆ 17th International Conference on Thin Films (ICTF-2017), CSIR-National Physical Laboratory, New Delhi, 13-17 November, 2017 <http://www.ictf2017.in/>
- ◆ Computational Plasma Physics Conference, University of York, United Kingdom, 20-22 November 2017 <http://cppc2017.iopconfs.org/home>

Past Events @ IPR

- ◆ **Dr. Pankaj Kumar Shaw**, Saha Institute of Nuclear Physics, Kolkata, gave a talk on "Investigation on nonlinear dynamics of self-excited plasma oscillations obtained from a DC glow discharge plasma" on 28th August 2017
- ◆ **Prof. Keisuke Hatada**, Department of Physics, Faculty of Science, University of Toyama, Japan, gave a talk on "Full Potential Multiple Scattering Theory with space-filling scattering sites for X-ray absorption spectroscopy" on 28th August 2017 (Colloquium # 276)
- ◆ **Dr. Sanat Kumar Tiwari**, University of Iowa, gave a talk on "Reduction of Electron Heating in a Magnetized Ultracold Plasma" on 30th August 2017
- ◆ **Dr. G. Veda Prakash**, Institute for Plasma Research, Gandhinagar, gave a talk on "Development of Impulse Generator for High Frequency E.M. Excitation" on 07th September 2017
- ◆ **Dr. Ashish Adak**, Jadavpur University, Kolkata, gave a talk on "Nonlinear Coherent Structures in Pair Ion Plasmas" on 08th September 2017
- ◆ **Mr. Arghya Mukherjee**, Institute for Plasma Research, Gandhinagar, gave a talk on "Breaking of Relativistically Intense Longitudinal Waves in a Homogeneous Plasma" on 8th September 2017
- ◆ **Dr. Arvind Kumar Saxena**, Institute for Plasma Research, Gandhinagar, gave a talk on "Study of atomic and molecular clusters generated by laser ablation source" on 11th September 2017
- ◆ **Ms. Akanksha Gupta**, Institute for Plasma Research, Gandhinagar, gave a talk on "Shear flows in 2D strongly coupled fluids: A theoretical and computational study" on 18th September 2017
- ◆ **Prof. Mahendra K. Verma**, Physics Department, Indian Institute of Technology, Kanpur, gave a talk on "What is the turbulence problem?" on 18th September 2017 (Colloquium # 277)

IPR @ Conferences



Sandeep Kumar, 5th year PhD Scholar of IPR attended the 8th International Conference on the Physics of Dusty Plasmas, Prague, Czech Republic, 20-25 May 2017. He made a poster presentation entitled "Observation of the Korteweg-de Vries soliton in molecular dynamics simulations of a dusty plasma medium" for which he won the best student poster award.



Vidhi Goyal, 6th year PhD Scholar of IPR attended the International Conference on Phenomena in Ionized Gases (ICPIG-2017), Estoril/Lisbon, Portugal, 9-14 July 2017. She made a poster presentation entitled "Optical Emission Spectroscopy Investigations in a Non-Transferred DC Plasma Torch"

IPR Flora & Fauna



(Left) The lotus bloom in the pond at IPR main campus (Right) Dancing peacock at the FCIPT campus



Mr. Vishnukumar B Patel, currently with the Science & Operations Department, Control Systems Division of the CODAC section of ITER, France as a CODEC programmer, was awarded E2000 in July 2017 in recognition of his high performance and achievement of goals in the past year. On behalf of IPR, the Newsletter congratulates him on his achievement. His major responsibilities at ITER include development of EPICS driver, development and Linux drivers, maintenance of PXI Digital IO boards and development of applications of the fast controller boards for CODAC users.

Know Our Colleagues



Mr. BVVSNNP Sridhar joined IPR in 1997 in the Neutral Beam Injection (NBI) division. His contribution in NBI development started with the conceptual design and further proceeded into the engineering design, fabrication of mechanical assemblies, and the final assembly & commissioning of the system. He is also one of the contributors for the NBI's 3.8 K cryopumps and Liquid helium refrigerator system. He is presently working on the mechanical configurations of the components, study the assembly feasibility and installation sequence of all injector components and its implementation. His other areas of expertise include CAD design (AutoCAD, MDT and CATIA), CAD data management, Piping & plant layout. He was deputed to ITER, France in 2009 where he worked as a design coordinator for Cryo-System, TBM and Tritium departments.

Mr. Dashrath Sonara joined IPR in June 1998 in Cryogenic Division of SST-1. He has been engaged in setting up DAQ system and sensor installation for various cryogenic experiments since he joined the institute. He was responsible for developing cryogenic temperature data acquisition system for SST-1 80K thermal shield, superconducting current feeder system and cryogen distribution system. He has developed in-house three port isolated cryogenic temperature transmitter device for SST-1 current feeder system to protect the system against induced high voltages on superconducting magnet during quench and plasma disruption. During SST-1 reassembly he contributed in engineering validation test for sixteen TF coils, thermal radiation panel, Superconducting current leads and CFS radiation shield. He developed TCP/IP based remote compressor station condition monitoring system for Helium refrigeration plant which has improved the safety aspect of the plant machines and is useful during SST-1 cool-down campaign. Mr. Sonara has also developed user friendly cryogenic heat leak and specific heat computation software "Qdot" which is a handy tool for cryogenic system designer. He received OSMY award for year 2001 for his outstanding performance.



The IPR Newsletter Team



(Standing, L-R) Shravan Kumar, Ritesh Srivastava, Mohandas K.K., Tejas Parekh, Priyanka Patel, Ravi A. V. Kumar, Harsha Machchhar, Dharmesh Purohit, (Sitting, L-R) Ramasubramanian N., Suryakant Gupta, Chhaya Chavda, Supriya Nair