

The editorial committee of the IPR newsletter wishes to thank all the IPR staff members for their encouragement and support that they have given to the revived newsletter. We hope that this will continue for all the forthcoming issues of "The Fourth State". Please feel free to send any comment / suggestion to the committee at <newsletter@ipr.res.in> for improvement of the look and contents of the newsletter.

SST-1 Open House

First phase of SST-1 upgradation has been completed with the Installation of First wall components in SST-1 in the record time of 9 months. This is the first time that the machine has been equipped with all the first wall components. Along with this, segmental PF-6 coil, some additional diagnostics like reciprocating Langmuir probe, static & movable Langmuir probes, Photo diodes, up graded Thompson scattering diagnostics, Supersonic molecule beam injection (SMBI), IR imaging and hard X-ray diagnostics for LHCD have also been installed. Gas puffing systems, Hot nitrogen baking system and pumping systems for SST-1 vacuum systems have also been upgraded during this time.



CGI view of the Plasma facing components

Inside view of the vacuum vessel after the assembly of in vessel components

As a celebration of the completion of phase-1 of SST-1 up gradation, an open house was arranged at SST-1 hall on 2nd June, 2015. On this occasion, large no of IPR staff and students have visited SST-1 machine. Dr. Surbrata Pradhan explained the installation activities through animation and photographs of installation activities.

After all the necessary checks and fulfillment of vacuum protocols, vacuum vessel of SST-1 was closed and pumping of vessel & cryostat commenced on the evening of 9th June, 2015. Currently, cool down of SST-1 machine is in progress. Ultimate vacuum level of 1×10^{-7} mbar has been achieved in vacuum vessel with baking. Next experimental campaign is expected to begin by early July.



Dr. S. Pradhan describing the PFC installation activities

Prof. Dhiraj Bora addressing the gathering during the open house



(L) Professor Kaw addressing the gathering during the SST-1 open house event. (R) Sharing some lighter moments with Prof. Kaw, Prof. Bora and others from the SST-1 team sporting the SST-1 Tee shirts !

Fostering Young Minds - SSP-2015

This year's Summer School Program (SSP-2015) began on the 1st of June. Forty-six students from all over India have joined the program. 30 students from physics background while 16 students from engineering background were selected for this year's SSP. The IPR SSP 2015 Committee members are ; Dr. P. Bandyopadhyay, Jinto Thomas, Santosh Pandya, Varsha Siju, Vinay Menon, Mitul Abhangi, Jyotishankar Mishra, Hiral Joshi, Dhaval Rajyaguru, Sumit Louhan and Sneha Singh.



Professor Dhiraj Bora welcoming the students of the SSP-2015. View of the participants during Inaugural address.

A weekend picnic was organized for the SSP 2015 students to the Little Rann of Kutch at Zainabad, around 120 kms from IPR on 13-14 June 2015. The students were taken for a safari in the expanses of the little Rann to see the Indian wild ass as well as the salt pans. They were also taken for birdwatching the nesting flamingoes. On their return, they also visited the Sun temple at Modhera.



The SSP students enjoying the safari in the little Rann at Zainabad.

IPR Outreach Programme

As part of IPR's ongoing outreach programme, an MoU was signed between IPR and St. Xavier's College, Ahmedabad for mentoring the graduate and post graduate Physics students of St. Xavier's college. As part of this MoU, selected Physics students from Xavier's will be mentored by the faculty of IPR and the students would be able to carry out scientific projects related to their curriculum at IPR. These students will also actively participate in IPR's scientific outreach programmes such as the annual Science Fair at IPR. IPR will provide assistance in the form of expertise in plasma physics to Xavier's with their PG programme in Physics which is slated to begin in the coming academic year.

The MoU was signed between Prof. Dhiraj Bora, Director, IPR and Fr (Dr.) Robert Arockiasamy, Principal of St. Xavier's College, Ahmedabad. The meeting was attended by the Dean, Prof. R. Jha, IPR Academic committee members and the IPR outreach activities team.



(L) The pre-signing meeting at the director's office. (R) Prof. Bora and Dr. Robert exchanging the MoU documents.

Development Of CZTS Based Thin Film Solar Cells At FCIPT

- R&D on low cost thin film based solar cells have bcome currently very popular specially, thin film solar cells based on Cadmium Telluride (CdTe), Copper Indium Gallium Diselenide (CuInGaSe2, also known as CIGS), and Copper Indium Disulphide (CuInS2, also known as CIS). These type of solar cells have shown higher conversion efficiencies (~ 21.7%) and high optical absorption coefficient (~ 5x10⁴ cm⁻¹). However, these absorber coatings have certain limitations too. In CIGS and CIS coatings, the scarcity of the rare element Indium (In) is the major shortcoming. In the case of Cadmium based absorber coatings such as CdTe, the vital drawbacks are the toxic nature of Cadmium and shortage of Tellurium. Hence, there is a great necessity for the development of thin film absorber coatings, free from Indium and Cadmium.
- Copper Zinc Tin Sulfide (CZTS) is one of the promising materials as an absorber layer in thin film solar cells because of its excellent material properties. It has a direct band gap of 1.45 eV, which is very close to the optimum band gap of the semiconductors used for photovoltaic solar energy conversion applications, and has high absorption coeff. (10⁴ cm⁻¹).



Multi chamber UHV system for CZTS solar cell development at FCIPT.

♦ FCIPT/IPR is developing this multilayer CZTS based solar cell with Mo layer as back contact, CZTS (absorbing layer), ZnS (Buffer layer) and Zno:Al (TCO layer), respectively.

 This project is funded by Department of Science and Technology (DST), Govt. Of India under Solar Energy Research Initiative (SERI) programme.

◆ The complete solar cell will be made in-situ in a UHV system consisting of four chambers and one layer will be made in one chamber sequentially. This system is already installed at FCIPT and various films are grown and optimised for the process.

• Recently a third year review completed successfully in which expert from DST visited FCIPT and reviewed throughly the project execution. Complete solar cell development is planed in near future.

Aditya Upgrade

Aditya Upgrade Team announced that they were able to complete the Aditya Tokamak disassembly **15 days before – schedule** on Friday (12th June, 2015) evening by 1830 hrs. The entire task is completed within 59 working days starting from 6th April, 2015 with ECDS measurements and marking of each and every component. More than 28 different components of the tokamak were removed during the course of the disassembly. The structure will now await the arrival of the new vacuum vessel.



(L) The base and the support system of the Aditya Tokamak seen after the vacuum vessel, magnets and all other components were removed. (R) The schematic of the support system for Aditya Tokamak

Indian Delegation at the ITER Organization Council Meeting

The 16th Council Meeting of the ITER Organization was held during 17-18 June 2015, at the ITER Organization office at St Paul Lez Durance, France . The seven member Indian delegation consisting of Dr. Shishir Deshpande, Mr. Ujjwal Baruah, Mr. R.A. Kumar (JS-F and FAB Chair – IO), Prof. Dhiraj Bora, Mr. Arun Srivastava, Prof. P.K. Kaw, Dr. R.B Grover participated in the deliberations.



The Indian Delegation at the ITER Organization Council Meeting (L-R) Dr. Shishir Deshpande, Mr. Ujjwal Baruah, Mr. R.A. Kumar (JS-F & FAB Chair – IO), Prof. Dhiraj Bora, Mr. Arun Srivastava, Prof. P.K. Kaw and Dr. R.B Grover

CPP-IPR Celebrates Diamond Jubilee of DAE

To mark the Diamond Jubilee year of Department of Atomic Energy, Govt. of India, CPP-IPR recently organized a series of

popular science talks at various places across Assam in collaboration with other institutions. The talks were delivered by former Director of Vigyan Prasar and popular science writer, Dr. V. B. Kamble, who is currently a consultant of the outreach programme of IPR. The title of the popular talk was "Fusion - Energy of the Future." Starting from the basic concept of plasma, the talk covered all the aspects of research and development of fusion science and technology leading up to India's participation in the International Thermonuclear Experimental Reactor (ITER) project. The first talk was organized in collaboration with Dibrugarh University and was delivered at Dibrugarh University, Dibrugarh, on 16th June, 2015. Along with the faculty members and students of the University, also in attendance were the students of nearby schools. The second talk was organized at the historic city of Tezpur on the northern bank of river Brahmaputra in collaboration with Tezpur University on 18th June. The venue was the centrally-located District Library auditorium, and the audience here includes general public in addition to school and college students. The third and final talk of the series was organized in collaboration with Cotton College State University and was held at the Department of Physics of the prestigious Cotton College, Guwahati, on 19th June. It was attended by students from various colleges in the city.



Dr. V. B. Kamble delivering the popular talk at Guwahati

All the talks were well-attended and well received among the public.

Dr. Kamble's long time association with Assam has given a pleasant hue to the talks, as he could interact with the audience in Assamese language. In fact, all the presentations were eventually turned into bi-lingual (English and Assamese) to the delight of the audience, particularly the school children. Prof. S. Bujarbarua, former Director of CPP-IPR also attended all the events and talked about the significance of atomic energy research and introduced Dr. Kamble to the audience.



View of the audience during the popular lecture by Dr. V B Kamble at Tezpur.

IPR'S Document and Record Management System (IDRMS)

IDRMS for IPR was developed in-house using Alfresco and open source Enterprise Content Management (ECM) framework. IDRMS will allow employees to share documents easily and securely. Users can log in the system by using https://idrms.ipr.res.in URL using any web browser.

Approximately 500 users are created and made active in the system. Public and Private workspaces are created to easier manage drafts and official documents. User's Manuals are developed and made available to users. Also a training workspace is created and made it available to users for hand-on self learning.

User's trainings sessions are already conducted and some more session will be organized in future.

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Public Welfare Activity

Under the auspices of the "Rameshim Foundation", caps and scarfs were distributed to the daily wage laborers to help them combat the fiery summer heat. Few of the IPR staff members, ie., Manoj Kumar Gupta, Yogesh Yeole, S.B. Bhatt, Shailesh Prajapati, Robby, Rakesh, Abhinav, Arvind, Ravi, Vipul Tanna, Atul and Ramesh B participated in this social service endeavor.



Images of the activity were daily wage laborers were distributed caps to combat the summer heat.

World Environment Day Celebrations at IPR

The World Environment Day was Celebrated at IPR on 5th June 2015. The program was organized by IPR Staff club committee. Plantations of various saplings were done by the IPR employees as well as the students of Summer School Program which is being held during this time at IPR. Images of the event are below.





An Advanced B.Sc. Physics course is organized every year by Gujarat Science Academy, Vikram A Sarabhai Community Science Center and St. Xaviers College, funded by Gujarat Council for Science & Technology (GUJCOST), IPR and Physical Research Laboratory (PRL).

It is a residential program for three weeks and this year it was during 16^{th} May – 5^{th} June. Thirty eight students who are in second year of B.Sc. from various institutions from all over Gujarat, attended the programme. These students were selected through an entrance test and an essay in physics. Faculties from PRL and IPR took lectures and did some interesting experiments.

Prof. Bora attended the valedictory function on 5th June 2015 and addressed the gathering .

Prof. Bora addressing in the gathering during the valedictory function

IPR Canteen Renovated

IPR canteen was re-opened after extensive renovation and refurbishment. The new kitchen is bigger, with state-of-the art equipment, and special care has been taken to use stainless steel furniture to ensure that cleanliness in the kitchen can be maintained. This renovation was carried out over a period of two months. The current seating capacity of the canteen is 160. An additional space in the canteen was created for organizing lunch etc. during events organized by IPR. The renovat-ed canteen was inaugurated by Prof. Ratneshwar Jha, Dean IPR on 15th June 2015.



(L) Prof. R. Jha inaugurating the renovated canteen. (R & Below) Views of the renovated canteen.



- Ms. Manjit Kaur, Institute for Plasma Research, Gandhinagar, gave a talk on "Poloidal Dust Rotation in Toroidally Symmetric Structure in DC Glow Discharge" on 29th May, 2015
- Mr. Sayak Bose, Institute for Plasma Research, Gandhinagar, gave a talk on "Experimental Study of Plasma Oscillation" on 29th May, 2015
- Prof. Cary B Forest, Department of Physics, University of Wisconsin, Madison, USA, gave a talk on "Chasing Fast Dynamos in the Plasma Lab and Other Pursuits" on 1st June 2015 (Colloquium # 251)
- Workshop on RFQ Accelerators and Associated Technologies, Institute for Plasma Research, Gandhinagar, 9-10 June 2015
- **Dr. Arvind Saxena,** Director, Defence Materials Research & Development Establishment (DMSRDE), Kanpur, gave a talk on "*Precursor Material for High Temperature Application*" on 11th June 2015
- Dr. Subrata Pradhan, Institute for Plasma Research, Gandhinagar, gave a talk on "Towards Steady State Operations: Ongoing initiatives in contemporary Tokamak & Stellarator devices" on 11th June 2015
- **Mr. Sandeep Rimza,** DGFS- Scholar, Institute for Plasma Research, Gandhinagar, gave a talk on "*Studies on Helium Cooled Plasma Facing Components (PFC) for tokamak based Fusion Reactor Applications*" on 19th June 2015

Upcoming Events

- 24th International Conference on Numerical Simulation of Plasmas (24th ICNSP), Colorado USA, 12-14 August 2015 http://www.icnsp.org/
- 5th International Conference on High Energy Density Physics (ICHED 2015), San Diego, California, 23-27 August 2015 http://iched2015.ucsd.edu/ICHED2015/Home.html
- 13th International Workshop on the Interrelationship between Plasma Experiments in Laboratory and Space (IPELS-15), Pitlochry, Perthshire, United Kingdom, 23-28 August 2015 http://ipels2015.iopconfs.org/home
- 37th International Free Electron Laser Conference (FEL 2015), Daejeon, Korea, 23-28 August 2015 http://qrc.or.kr/ fel2015/
- 2015 International Conference on Plasma Physics and Applications (PPA 2015), Shanghai, China, 25-27 August 2015 http://www.engii.org/ws/Home.aspx?ID=629



Know Our Colleagues

Mr. Rakesh L. Tanna joined IPR in 1993 in the Aditya Tokamak Operation Group. Presently he is the section head and the chief machine operator of the group contributing highly in the fields and studies of operational as well as scientific aspects of the Tokamak. He has received one year operational training in DIII Tokamak at the General Atomics under the Indo–US collaboration program where he could involve in the analysis of disruption data base which helped him to do the same in Aditya and to submit data to ITPA. He has 12 peer reviewed journal publications and has won the 'Best poster presentation awards' category in last three consecutive PSSI symposi-

ums. Right now he is involved in the dis-assembly and re-assembly of Aditya Tokamak in the ongoing system upgrading operation.

Mr. Kanubhai Parmar joined IPR in 1993 in the RF division and was involved in PCB layout design, assembling ,wiring and testing of various electronics circuitry of DACs, power supplies, and in the maintenance of electronics equipment used in his section. After doing higher studies he re-joined the Institute in the same group in a higher capacity and engaged in development, operation and maintenance of various High Power and High frequency power systems for ICRH, ECRH and LHCD. Since 2008 he is with the Negative Ion Neutral Beam System developing electrical systems for negative Ion source as well as infrastructure for NBI Laboratory.



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