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The Fourth State

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

End of an Era - Professor Predhiman Krishan Kaw (1948-2017)

The father of India's nuclear fusion reactor research programme, Padma Shri Professor Predhiman Krishan Kaw, passed away on Sunday, 18th June, 2017. He was the founder director of Institute for Plasma Research (IPR), Gandhinagar, an institute that catapulted India to being one among the seven member entities that is building the world's largest fusion experiment - the US \$ 14 billion International Thermonuclear Experimental Reactor (ITER). Prof. Kaw was the first chairman of the ITER Council Science and Technology Advisory Committee and led the committee's deliberations from 2007 to 2009.

Professor Kaw, born in Kashmir, had an unusual childhood. He was an extraordinary student and was home schooled by his uncles and grandfather. Prof. Kaw passed his MSc at the age 16 from MMH College in Ghaziabad. He then joined IIT-Delhi and was awarded the premier institute's first PhD at the age of 18. Prof. Kaw always remembered his professors at MMH college Ghaziabad - especially by Dr. Chandra Bhushan, Dr. P. K. Agarwal, and Dr. Singh who inspired him to study physics. At IIT, he was a researcher under Prof. M. S. Sodha, who introduced him to plasma physics, while Prof. Kaw's initial interest lay in high-energy physics.

Professor Kaw was a researcher at the Physical Research Laboratory (PRL) in Ahmedabad in its new plasma division in 1982, after working under Prof. John Dawson of Princeton Plasma Physics Laboratory, USA. In 1986, Prof. Kaw began a full-fledged institute that spearheaded the establishment of a national magnetic fusion program in Ahmedabad, founding the Institute for Plasma Research and playing a leading role in gaining international recognition for the national program. He began building India's first Tokamak machine 'Aditya' which continued into the Steady State Tokamak machine (SST-1). His colleagues at IPR remember how he used to spend 10 to 12 hours a day managing the institute and in the evening dedicated his time for plasma physics.

Recently, he was named the 2015 laureate of the Subrahmanyan Chandrasekhar Prize for "Outstanding contributions in the field of plasma physics". He has authored more than 308 research papers. Among the 15 awards and fellowships he had won in his lifetime, Prof. Kaw cherished the SS Bhatnagar award he received in 1986 and the Indian National Science Academy's Young Scientists Award of 1974, which was conferred on him by the late Prime Minister, Smt. Indira Gandhi. As a true scientist, his advice to students would always be "As young physicists of this country, you should think very seriously about taking an opportunity to develop some areas of science for your country."

It is indeed a big loss not only for the staff of IPR, but to all those who knew him personally as well as professionally. On behalf of IPR, the IPR Newsletter expresses our heartfelt condolences to his family. May his soul rest in eternal peace !



Prof. P. K. Kaw (1948-2017)





Images of Prof. Kaw from 1968, courtesy Ms. Asha Bakaya whose father Dr. Dwarikinath Saraf, was a mentor to Prof. Kaw.

Condolence Meeting - Professor P. K. Kaw (1948-2017)

A condolence meeting to mourn the sad and untimely demise of Prof. P. K. Kaw, Founder Director, Institute for Plasma Research, was organized in the evening of 28th June 2017 at IPR. The meeting was attended by majority of IPR staff. The meeting began with a brief introduction by Mr. P K Atrey followed by a 2 minute silence in respect of the departed soul. Then, Dr. Shashank Chaturvedi read out the condolence message in behalf of IPR staff. Professor Abhijit Sen spoke about his long professional and personal association with Prof Kaw. This was followed by Prof. Amita das who read out the condolence messages received from all over the world. Dr. Chenna Reddy and Mr. Ujjwal Baruah also spoke briefly about Prof. Kaw. The meeting ended with IPR staff paying their homage to the garlanded photograph of Prof Kaw.



(L) Dr. Shashank Chaturvedi reading out the condolence message on behalf of IPR staff (R) IPR staff who attended the meeting.



(L-R) Dr. Shashank Chaturvedi, Prof. Amita Das and Prof. Abhijit Sen paying their respects to the departed soul.



(L-R) Prof. Amita Das reading out the condolence messages received from various parts of the world.
Prof. Abhijit Sen speaking about his association with Prof. Kaw; Dr. Chenna Reddy sharing his thoughts about Prof. Kaw



(L-R) Mr. Ujjwal Baruah speaking about Prof. Kaw; IPR staff paying homage to Prof. Kaw.

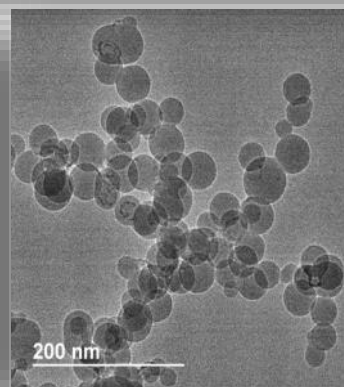
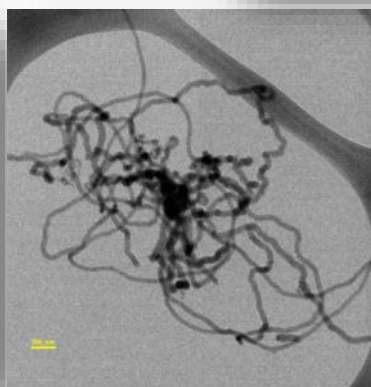
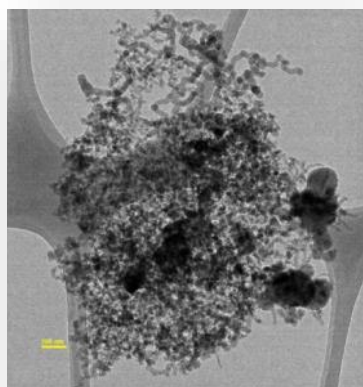


IPR Staff observing the 2-minute silence as a mark of respect to the departed soul.

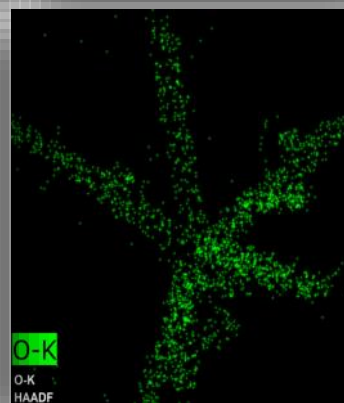
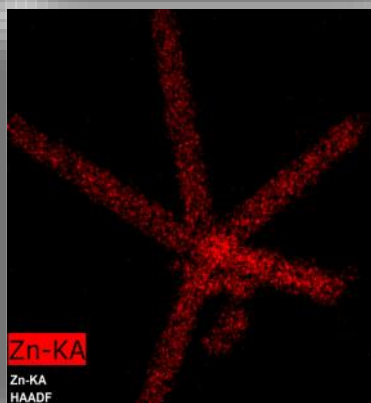
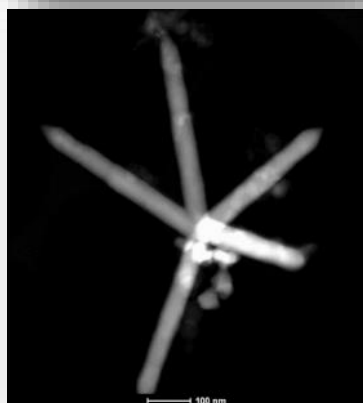
Field Emission Transmission Electron Microscope at FCIPT

FE-TEM uses electrons that travel through an extremely thin sample to image that sample. The images have very high spatial resolution on the order of a few Angstroms. A high resolution, 300 kV FETEM was procured and installed at FCIPT, IPR. The TEM is FEI make and the model is Tecnai G2 F30. The instrument is equipped with EDX, STEM, and EELS accessories. The instrument can be used basically for high resolution imaging, crystallographic studies, defect identification & analysis, and also to obtain chemical information from nano-sized particles and features. A special laboratory (~18 x 6.5m) consisting of the room to house the TEM instrument, room for auxiliary units, TEM sample preparation room, and a room for housing the precision AC unit. was constructed to house this very sensitive machine. This device is being used for various material science analysis. Some of the interesting analysis are given below.

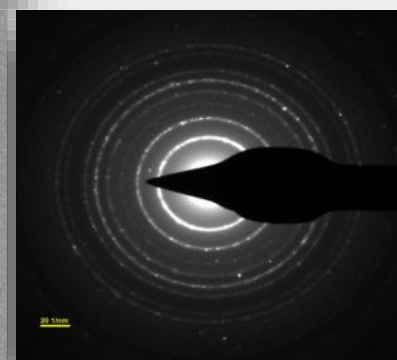
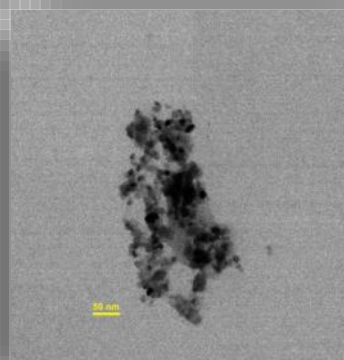
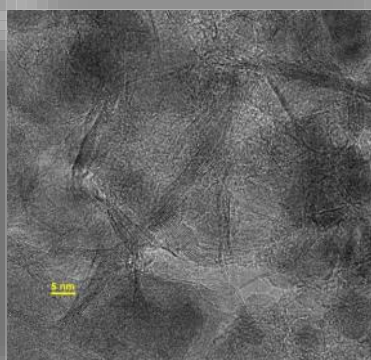
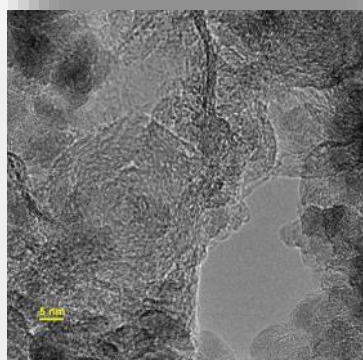
The photograph of the Tecnai G2 F30 Field Emission Transmission Electron Microscope installed at FCIPT.



TEM images of SiC particles, synthesized at FCIPT using a thermal plasma arc at 125, 150 and 200 A (Left to right). It is clearly seen that the size and shape of the produced particles are dependent on the process parameters. This feedback can be used for optimizing the process operating parameters, if any inconsistencies are observed.



Elemental mapping using the device : TEM images of ZnO nano-wires produced using thermal plasma route. Even though the nano-wires are very small in size (20-30nm), this device could carry out the elemental mapping which can be seen in the two coloured images. The images show the distribution of Zn and O, thus clearly indicating the composition of the sample i.e., ZnO.



(L-R) (1&2) TEM images of 2D sheets of graphene produced using thermal plasma process showing the various shapes of these sheets. (3) TEM image of Tungsten powder (4) Its electron diffraction pattern.



Clockwise (from top) : The electric panel work in the auxiliary building ; The laboratory building roof erection work in progress ; the storm water drain work in-progress; Work on the control room in the auxiliary building in progress.

IPR Divisions & Groups : Engineering Design and Analysis (EDAS)

The newly formed section “Engineering Design and Analysis (EDAS)” will aim to provide engineering design related support to all IPR sections at all levels starting from conceptualization to commissioning.



The EDAS Section (L-R) : Ritesh Srivastava, Snehal Jayaswal, Prosenjit Santra, Prabal Biswas, Manoj Kumar Gupta, Prati-bha Gupta, Bharat Doshi, Alli Amardas and Pradeep Chauhan

Workshop on Basics of Project Management

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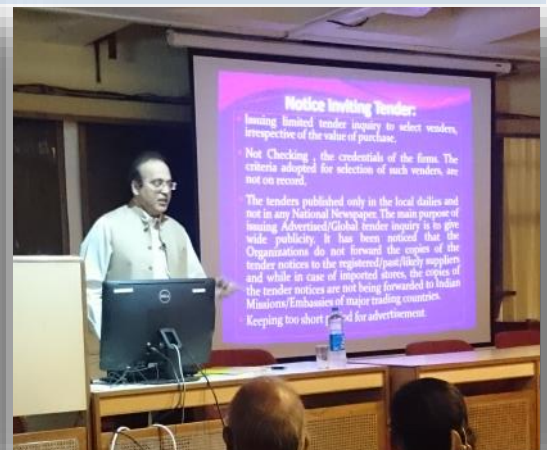
A 2-day hands-on workshop on “Basics of project management” was conducted at IPR by Dr. J Govindarajan during 14-15 June, 2017. The workshop dealt with the basics of how to manage projects efficiently. Basic talks on various aspects of project management (12 modules), hands-on group activities and group discussions were highlights of this workshop which was attended by 15 IPR staff members. The course was coordinated by Ms. Rekha Singh of Administration Dept.



Dr. J Govindarajan conducting the workshop on project management

Talk by CVO, Indian Rare Earths Ltd., Mumbai

On 15th June, 2017, Shri Sanjay Banga, IES, the Chief Vigilance Officer of Indian Rare Earths Limited, Mumbai delivered a very interesting and informative talk on vigilance related topics including certain mandatory requirements to be followed by Government servants as per CCS rules, such as issues related to declaration / approval of immovable / movable properties and property transactions, issues covering procurement and common irregularities in Tenders, Surprise checks and Systematic improvements etc. This interesting talk received a full-house attendance by IPR staff. The talk was coordinated by Dr. Anitha V. P., Chief Vigilance Officer, IPR.



Images from the talk by Shri. Sanjay Banga, CVO, IRE Ltd., Mumbai

The CPP-IPR campus, being in the vicinity of paddy fields and swamps, is rich in frog population as well as other flora and fauna. And with the coming of the monsoon, they all seem to have come alive, croaking as the evening approaches. At least six species were recorded recently, which could actually be much more, if a proper survey is conducted. They include ornamented pigmy frog measuring 28 mm from snout to vent, which is one of the smallest frogs in our country as well as the Indian bull frog, measuring 134 mm, which is the largest Indian frog.

Frogs are not only very sensitive to changes in the environment, especially to pollution and so, are bio-indicators of the health of the environment around us, but also play a very important role in control of insects, which may be agricultural pests or insects that transmit diseases. They are also located right in the middle of the food chain. So, as long as we have a good population of frogs around CPP-IPR campus and hear them croaking as we go home in the evening, no matter how deafening they may be, we can rest assured that we still have a pollution free environment around us. So, dear frogs, happy croaking !!

- Dr. Ngangom Aomoa

Two species of frogs found in the CPP-IPR campus (Top) Common tree frog (*Polypedates teraiensis*) (Bottom) Assam forest frog (*Sylvirana leptoglossa*)



IPR @ Meetings

Mr. Anuj Harvey (APIO, IPR) and Dr. Ravi A V Kumar (PIO, IPR) attended the 2-day "Workshop on Right to Information Act, 2005", which was organized by the National Academy of Human Resources Development, New Delhi, at Udhagamandalam, Tamilnadu during 20-21 June 2017. The workshop was chaired by Shri. K. S. Kumar (Former Director, ISTM, DoPT, Govt.



Of India) and Shri. Mahabir Singh Kasana (former Joint Director, ISTM, DoPT, Govt. Of India and a noted legal luminary on RTI and service matters).

The workshop had lectures, case studies and hands-on mock RTI cases which were discussed and solutions to various RTI problems were analyzed in detail. The team also updated the 20 participants (PIO's and APIOs) from various government and public sector institutions on the latest rulings on RTI. Certificates were also awarded to the participants after the completion of the workshop.

Shri Anuj Harvey (Left) and Dr. Ravi Kumar (Right) receiving the participation certificates from the course Chairman Shri. Mahabir Singh Kasana.



First Batch of Cryolines From India Enroute to ITER

The Cryolines, part of India's in-kind contribution to ITER have reached an important milestone. The first batch of Cryolines consisting of Nitrogen Cryolines and relief lines of total length of about 350 meters have been dispatched in three 40-foot open top containers. Specially designed metallic frames ensure proper and secure placement of these Cryoline elements for road and sea transport. At the manufacturer's Inox India Limited facility in Kalol near Vadodara, a flag-off ceremony was held on 17th May 2017 in the presence of personnel from ITER-India and the manufacturer. These containers are on board the vessel CMA CGM TOSCA that departed from the Jawaharlal Nehru Port near Mumbai in the morning of 3rd June 2017 and expected to France in a month's time. Several similar shipments will continue in batches over the next 18 months.



(Left) Loading of Cryolines in the Container along with specially designed frames (Right) Flag-off ceremony at the manufacturer site.



(L to R): Mr. Akshay Patel, Mr. Yashraj Mehta, Mr. Abhishek Jhala, Mr. Ninaad Desai, Mr. Neel Vadodariya, Mr. Pratik Thakkar, Mr. Naman Vora, and Ms. Shwetangi Mehta

IPR has been organizing the National Science Day (NSD) with a lot of enthusiasm and participation from schools all over Gujarat since the last four years. In this endeavor, the first year BSc Physics students of St. Xavier's College, Ahmedabad have been active participants in organization of the last three editions of IPR-NSD as well as assisting IPR staff in putting up various scientific exhibits. It is a pleasure to note that 8 out of the 20 B.Sc. students from St Xavier's college who were recently selected for doing their projects at IPR had volunteered and worked for different science exhibitions in NSD-2017. On behalf of IPR, the Newsletter congratulates them on their selection and extend our warm welcome to them.

IEEE Session on Authoring Quality Technical Papers at IPR

IPR Library organized IEEE session on "Authoring Quality Technical Papers" on 09 June 2017 at IPR Seminar Hall. The session was conducted by Mr. Dhanu Pattanashetti from IEEE. The session included various aspects of Publishing choices, Article structure and Where to publish, Publishing Ethics, Open Access and Impact Factor, Authoring Tools, Time-saving features for your research using IEEE Xplore Digital Library, Keeping track of latest publications, Interactive HTML article for efficient reading and many more. The interactive session was attended by a large number of staff members and students.



Health Awareness Programme at IPR

As part of the health awareness program of the IPR Staff Club, a seminar was organized at IPR to provide information regarding prostate cancer and kidney stones. The talk was delivered by Dr. Janak Desai, B.C.Roy awardee from the Medical Council of India and currently working as Urologist at the Samved Hospital, Ahmedabad. Information about the health issues, preventive cures and available medicinal options and current available technologies were explained in detail by Dr. Desai. The em-



Dr. Janak Desai



phasis was to spread awareness about the causes of the health issues and preventive or the early stage self-diagnostics. An organization with healthy employees enhances the productivity, creates a healthy society.

International Yoga Day was organized on 21st June 2017 at IPR by the Staff Club. The day started with a YOGA session in the morning under the guidance of experts, followed by interactive talk on “*Benefits of yoga for Stress management and Good health*” in which the experts explained as to how Yoga helps in releasing the stress and can be useful for the better living. IPR employees participated in large number with positive energy and enthusiasm, where they learned and performed various yoga postures and *aasanas*.



Adieu !!

Dr. Jagannathan Govindarajan, Scientist-H retired from IPR on 30th June, 2017. After completion of his PhD IIT Kanpur in 1987, and Postdoctoral fellowships at IIT Kanpur and IPR, he joined IPR as a Fellow in May 1990. During his tenure at IPR, Dr. Govindarajan worked in various areas such as Laser Spectroscopy, Plasma Diagnostics, Infra-red Thermography, NDE and Image Processing. He was a Visiting Researcher at ITER, France in 2012 and further went on to be a Diagnostics Physicist/ Engineer at ITER, France between 2013 and 2017.

On behalf of the staff members of IPR, the Newsletter wishes him a very happy, healthy and fruitful retired life !



Mr. Hradesh Kumar Sharma, Accounts Officer - II resigned from IPR on 30th May 2017. Mr. Sharma joined IPR in June 2003 as Accounts Officer-I and spent 14 years in Institute. A science and law graduate from Barkatullah University, Bhopal, Mr. Sharma is also a qualified accountant from the Institute of Cost and Works Accountants of India (ICWAI), Kolkata. He has taken up the post of Deputy Registrar at the Indian Institute of Technology, Gandhinagar, Gujarat.

On behalf of IPR, the Newsletter wishes to thank him for his services rendered to IPR and also wish him all the very best in his future endeavors.



- ♦ **Mr. Debraj Mandal**, Institute for Plasma Research, Gandhinagar, gave a talk on "Collective plasma structures with kinetic nonlinearity: their coherence, interaction and stability" on 29th May 2017
- ♦ **Dr. Sunil Rawat**, Bhabha Atomic Research Centre, Mumbai, gave a talk on "Deformation and fracture of metallic single crystals" on 9th June 2017
- ♦ **Mr. Harish Charan**, Institute for Plasma Research, Gandhinagar, gave a talk on "Yukawa Liquids Under External Forcing: A Molecular Dynamics Study" on 13th June 2017
- ♦ **Dr. Subrata Pradhan**, Institute for Plasma Research, Gandhinagar, gave a talk on "Carbon nanotubes influencing ampacity enhancement of graphite by virtue of significant improvement in electrical conductivity in arc plasma treated graphite disk" on 14th June 2017
- ♦ **Prof. Laxminarayan Raja**, Aerospace Engineering & Engineering Mechanics, The University of Texas at Austin, USA, gave a talk on "Computational Modeling of Microplasma-Wave Interactions for Plasma-Based Reconfigurable Metamaterial and Photonic Crystal Applications" on 21st June 2017 (Colloquium # 272)

Upcoming Events

- ♦ Exploratory Plasma Research Workshop, Vancouver, British Columbia, Canada, 1-4 August 2017 <http://icworkshops.org/epr2017/>
- ♦ International Workshop on Topological Structures in Ferroic Materials, 8-10 August 2017 <http://topo2017.iopconfs.org/home>
- ♦ 2017 Pacific Symposium on Pulsed Power and Applications, Waikoloa, Hawaii, USA, 8-11 August 2017 <http://www.p3e.ttu.edu/symp2017/>
- ♦ 10th International Conference on Dense Z-Pinches, Stateline, NV USA, 13-17 August 2017 <http://www.dzp2017.com/>
- ♦ 11th Serbian Conference on Spectral Line Shapes in Astrophysics, Sabac, Serbia, 20-25 August 2017 <http://servo.aob.rs/scslsa11/>
- ♦ 5th International Conference on Dusty Plasmas in Applications, Odesa, Ukraine, 25-30 August 2017 <http://dpa.onu.edu.ua/>
- ♦ NBIA Summer School on Astrophysical Plasmas - From Planets to Galaxies, Niels Bohr Institute, Copenhagen, Denmark, 28 Aug 2017 - 1 September 2017 <http://nbia.nbi.ku.dk/nbia-school-2017/>

Know Our Colleagues



Mr. Hitesh Kumar Gulati belongs to the IPR Technical Trainee batch of 1997 and later on joined the Institute in 1998 as an engineer. He is one of the founder members of the SST-1 Operation and Control Division and was involved in the design and development of various SST-1 control systems. He mainly contributed in the design, procurement and testing of conventional and real-time Networks and also the Control room infrastructure for SST-1. He has participated in several SST-1 operation campaigns since its inception. He was deputed to ITER organization, France in 2008 as a Computing Technology Specialist for Infrastructure. During his tenure there till 2013 he worked in the CODAC Section of Control System Division. Since October 2016 he is a member of the LIGO Preparatory Group and is working in developing Control and data acquisition System infrastructure for the project. He is holding the responsibility of the General Secretary of IPR staff club for the period 2017-2018.

Mr. Yogesh Govind Yeole joined IPR as a technical trainee in the year 1997 after completing B.E. in Instrumentation. He started with SST-1 Power Supply Division on VMEbus based Data acquisition System and was involved in the development of quench detection circuit for the superconducting magnet of SST-1 Magnet Division. He has contributed in developing data acquisition systems for SST-1 for its different groups. These include systems and electronics for Pellet Injection Group as well as for the Vacuum Group where PXIbus based hardware and LabVIEW programming language based software were applied. He also worked for the development of PID controller based furnace temperature control system and in related activities for the Magnet Prototype Division. He is presently with the Non-neutral Plasma Division developing data Acquisition System and associated electronics for SMARTEX-C experiment system. He has prepared a temperature controlled baking for the system and is in the process of designing an automated Vacuum System for the same. He is involved in all the activities of the division like maintenance of lab equipment, instrumentation, electronics and software development in LabVIEW.



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 Nair	Harsha Machchhar