

Issue 078

January 2020

# The <sup>4</sup>th State

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



Wishing All IPR Staff Members A Very  
HAPPY NEW YEAR

2020

## Vigyan Samagam @ Kolkata - Week 5





A one day seminar "Plasma Technologies for Health Sector (PTHS-2019)" was held at IPR. Around 120 delegates from various health sectors (Hospitals, R&D centres, academic institutions and private industries and medical practitioners) participated in the event. Dr. Sudeep Gupta (Director ACTREC, TMC Mumbai), Dr. Srikanth Prasad Tripathy (Director NIRT, National Institute for Research in Tuberculosis, Chennai), Dr. Sarat Chandra (AIIMS, New Delhi) were the guests of honour for the event. The purpose of organising PTHS-2019 seminar was to introduce the Indian community of medical practitioners, biotechnologies, bio-researchers, and Bio-industries about current development in the field of plasma medicine and particularly efforts of Institute for Plasma Research (IPR) in this direction. The Convener and Co-Convener of this seminar was Dr. Mukesh Ranjan and Mr. Akshay Vaid respectively.



(L) Dignitaries on the dais (M) Inauguration of the seminar (R) Dr. Shashank Chaturvedi addressing the gathering



(L-R) Dr. Mukesh Ranjan, Mr. Akshay Vaid, Dr. Alphonsa Joseph and Dr. Rama Krishna Rane delivering their talks.



(L-R) Dr. Srikant Tripathi, Dr. Sharat Chandra, Dr. Sudeep Gupta, Mr. Agraj Abhishek and Dr. Sudhir Nema delivering their talks.



Group photo of the attendees of the one-day seminar



As part of the PTHS-2019, the participants were given a tour of the FCIPT facility and a glimpse of the R&D work being carried out there in the area of plasma applications.



View of the audience during the seminar



Images from the visit of the participants to FCIPT



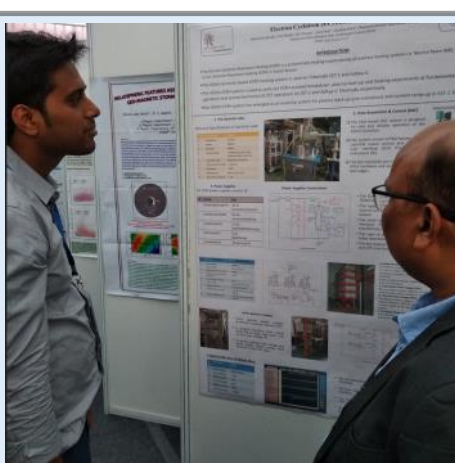
Department of Physics, School of Science, RK University, Rajkot organized a "Hands-on Workshop on Applied Physics" during 2-6 December, 2019. IPR Outreach participated in this event by giving popular talks as well as hands-on demonstrations on plasma and its applications.



## IPR @ Conferences



Mr. Vivek Pachichigar (JRF) received the best oral presentation award at the 5th International Conference on Nano-structuring by Ion Beams (ICNIB-2019) at IGCAR, Kalpakkam for his presentation entitled "Static and Dynamic Wettability Behaviour of Superhydrophobic PTFE Surface Prepared by Low Energy Ar<sup>+</sup> Ion Beam Irradiation"



Mr. Mahesh Kushwaha received the Best Poster Award for his poster entitled "Electron Cyclotron (EC) Power Supply System" presented at the International Conference on Plasma Science and Applications (ICPSA-2019) held at Lucknow University during 11-14 Nov., 2019.



Dr.-Ing. Vipul L. Tanna delivered a popular lecture on - "Plasma Science and its Technological Applications at IPR" at the Government Science College, Jabalpur (MP) as part of the "JIGYASA-2019" event which was organized by "UMNESH Gyan Vigyan Vichar Sangathan" and supported by DAE Outreach during 02-03 December 2019.



IPR participated in the 34th National Symposium of Plasma Science & Technology (Plasma-2019) which was held at VIT, Chennai campus from 3-6 December, 2019. The Guzdar Young Scientist award was presented to Dr. Remya Bhanu, Fellow, Indian Institute of Geomagnetism, Mumbai, and the Z. H. Sholapurwala Award for Outstanding Contributions in the area of RF and Microwave Applications for the year 2019 was awarded to Dr. Ranajit Dey of Space Application Center (SAC-ISRO), Ahmedabad. A total of 159 people participated in the conference from IPR, ITER-India and CPP-IPR,

#### Winners of Plasma-2019 awards from IPR

|                              |   |                             |
|------------------------------|---|-----------------------------|
| Mr. Suman Dolui              | Forecasting of Disruption in ADITYA-U Tokamak   | PSSI Poster Award           |
| Mr. Bharatkuamar Arambhadiya | Development, testing & commissioning of automatic charging of high voltage capacitor bank in Aditya-U tokamak | Sholapurwala Poster Award-1 |
| Mr. Vishnu Patel             | Conceptual design of data acquisition and control system of large scale cryogenics plant system               | Sholapurwala Poster Award-2 |



(L) Dr. Ranajit Dey receiving the Sholapurwala Award (R) Dr. Remya Bhanu receiving the Guzdar YS Award



(L) Releasing the Abstract book during inauguration (R) Ms. Anshu Verma (IIT-D) receiving the Buti YS award





## Educational Visits to IPR/FCIPT – Nov-Dec 2019

| Name Of the Institution                                       | Date        | Number of visitors  |
|---|-------------|---|
| Participants of the ISRO-Induction Training Program-(IITP-32) | 29-Nov-2019 | 47 nos. organised by HRD Division, Space Application Center, Ahmedabad. |
| Dr. Vishwanath Karad MIT World Peace University, Pune         | 05-Dec-2019 | 70 students (SY B.Tech, Mechanical Engineering) and 4 faculty           |



Participants of the ISRO-Induction Training Program-(IITP-32), during their visit to IPR



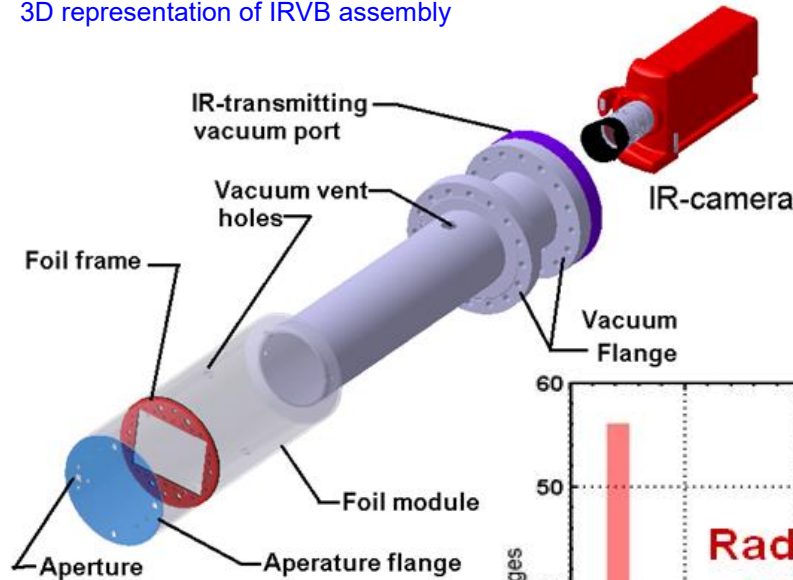
Students from Dr. Vishwanath Karad MIT World Peace University, Pune, during their visit to IPR



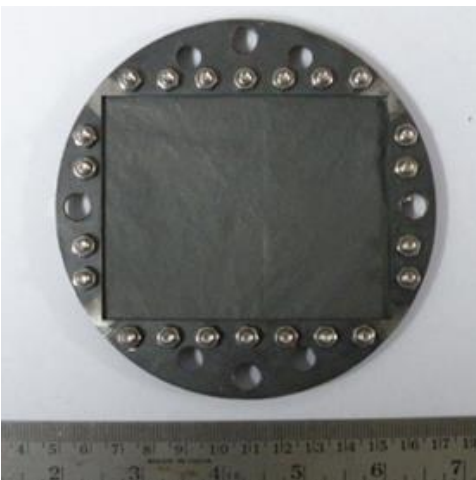
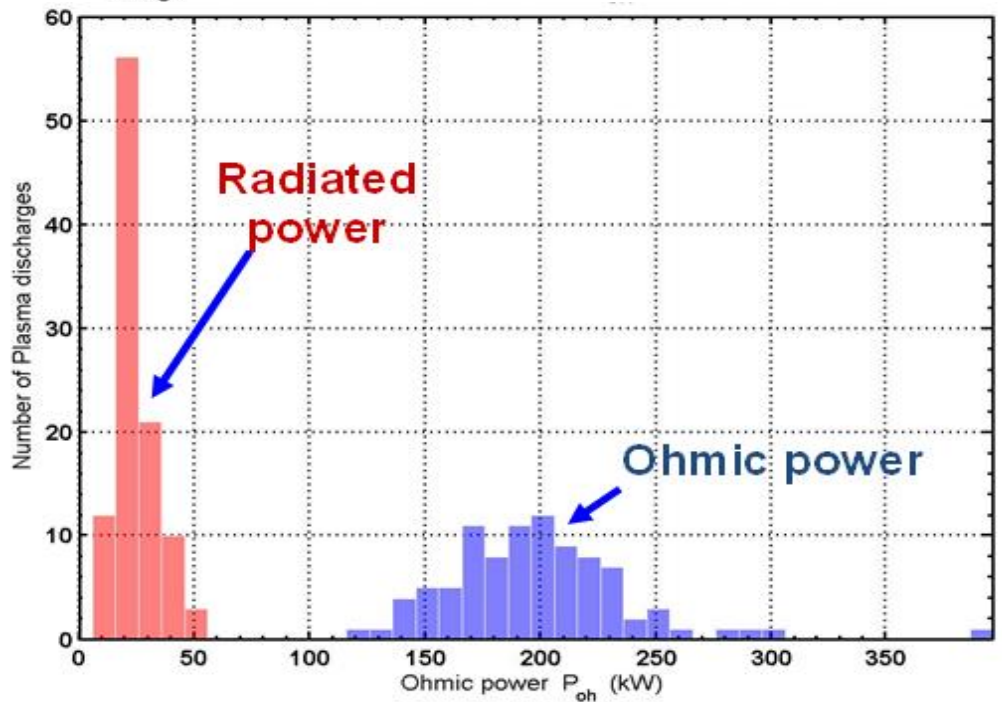
Power loss from the magnetically confined plasma due to impurity radiation has been a subject of great interest as it plays a vital role in the overall power balance of the plasma discharge. High impurity radiation lowers the plasma temperature and hence leads to unstable configuration, terminating the discharge. The measurement of radiation loss from the plasma is an important parameter measured by bolometers. Recently, the Infrared imaging Video Bolometer (IRVB) has emerged as a powerful tool for imaging the plasma radiation in two dimensions.

The IRVB has a simple pin-hole geometry. An aperture in the plate collimates the radiation from the plasma onto a 2.5  $\mu\text{m}$  thick, graphite coated, metal foil held in a copper frame mounted inside a modular light-shielding tube made of aluminium. The foil acts as a radiation absorber and an infrared camera monitors its temperature through an IR vacuum window. The power falling on the IRVB foil is estimated by numerically solving the 2D heat diffusion equation using the spatiotemporal variation of the foil temperature measured by the IR camera and the thermal-physical and optical properties of the foil. The foil is thoroughly calibrated to estimate its thermal and optical parameters.

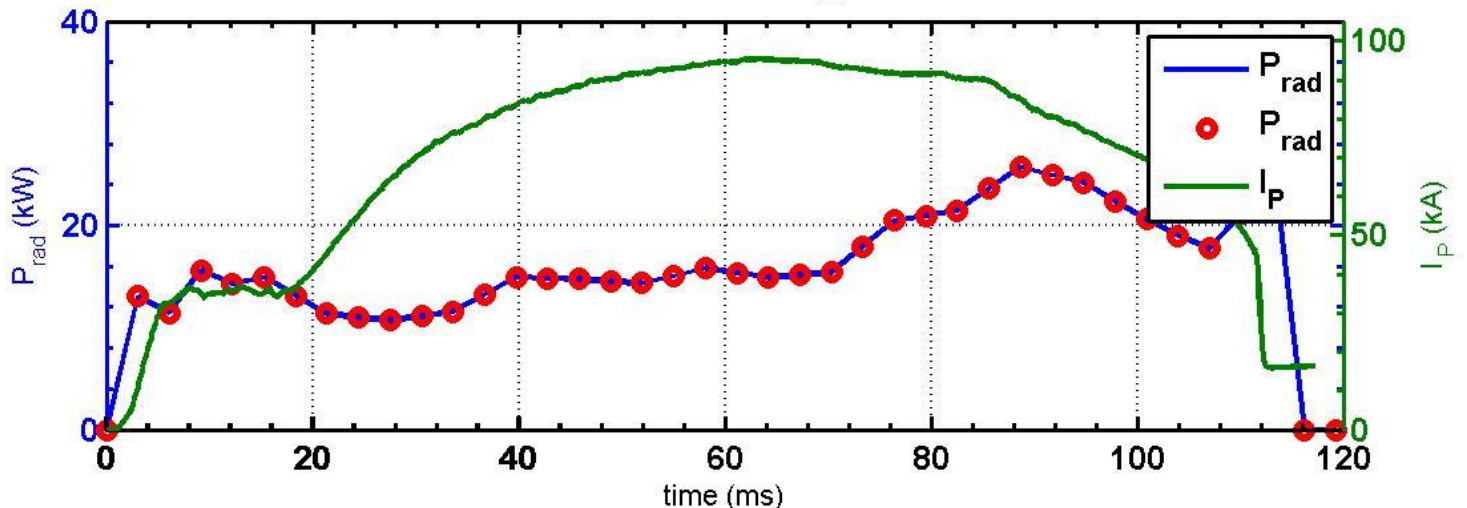
## 3D representation of IRVB assembly



A statistics of radiated power fraction ( $f \sim P_{\text{rad}}/P_{\text{in}}$ ) during the current flattop for several plasma discharges of Aditya tokamak is presented in Figure 2. It is observed that the radiated fraction ranges from 5% to 20% of the ohmic input power. This diagnostic has been successfully operated on Aditya, Aditya-U, and SST-1. Several inherent problems due to the ultra-thin metal foil in conventional IRVB are addressed by a patented (Indian Patent # 290634) diagnostic module called "DeLaS-IRIB," which stands for Deposited Layer Substrate - Infrared (IR) Imaging Bolometer.



(L) Thin metal foil mounted on a copper mask (R) Radiated power fraction statistics for several Aditya discharges



Temporal evolution of total power radiated  $P_{\text{rad}}$  and Plasma current [CN12]

In compliance with Government norms, on 27th. Nov 2019, IPR has signed an agreement with the Metal Scrap Trading Corporation (MSTC, a Government of India approved e-Auction platform) for the disposal of different kinds of scrap items (electronics, hazardous, metal, non-metal, equipment scraps etc.). From now on, all above mentioned scrap items will be disposed off through this agency. The agreement was signed by Shri Niranjana vaishnav, CAO IPR and Ms. Shalini Bhatti, Branch Manager, Varodara Branch of MSTC Limited.



## प्लाज़्मा अनुसंधान संस्थान द्वारा विज्ञान नाटिका का मंचन

हिंदी विज्ञान साहित्य परिषद् के स्वर्ण जयंती के अवसर पर हिंदी विज्ञान साहित्य परिषद्, भाभा परमाणु अनुसंधान केंद्र, मुंबई द्वारा अणुशक्तिनगर, मुंबई में 28-30 नवंबर, 2019 के दौरान त्रिदिवसीय अखिल भारतीय हिंदी विज्ञान सम्मेलन का आयोजन किया गया, जिसमें विज्ञान/तकनीकी के विभिन्न क्षेत्रों के महानुभावों द्वारा वार्ता एवं पैनल चर्चा के अलावा परमाणु ऊर्जा विभाग की विभिन्न इकाइयों के बीच हिंदी में एक विज्ञान नाटिका प्रतियोगिता रखी गई। प्रौद्योगिकियों के विकास के साथ समाज को वैज्ञानिक दृष्टिकोण प्रदान करने के उद्देश्य से इस नाटिका प्रतियोगिता का आयोजन किया गया, जिसमें भारी पानी बोर्ड, बड़ौदा, मद्रास परमाणु बिजली घर, कलपक्कम, एनआरबी, तारापुर, एस्ट्रेक खारघर, आईपीआर, गांधीनगर आरआरकैट, इंदौर, ईसीआईएल, हैदराबाद, द्वारा कुल सात नाटिका प्रस्तुत की गई।

आईपीआर की विज्ञान नाटिका 'विज्ञान मंथन' को श्रेष्ठ मनोरंजक नाटिका का पुरस्कार प्राप्त हुआ। समापन सत्र में डॉ. आर. चिदंबरम, पूर्व अध्यक्ष, पऊआ एवं सचिव, पऊवि ने सभी विजेताओं को पुरस्कृत किया। इस नाटिका के प्रतिभागी थे: श्री आलोक बालाजी नचिकेता, वैज्ञानिक अधिकारी-डी, श्री योगेश दधीच, सहायक भंडार अधिकारी, श्री नितिन बैरागी, वैज्ञानिक अधिकारी-डी, श्री योगेश योअले, वैज्ञानिक अधिकारी- एफ, सुश्री भूमि संदिप गज्जर, वैज्ञानिक अधिकारी-डी, डॉ. संध्या पी. दवे, हिंदी अधिकारी, डॉ. प्रवीण कुमार आत्रेय, डीन (आर एंड डी) और डॉ. मनोज कुमार गुप्ता(ईज), वैज्ञानिक अधिकारी- जी।



(L) बाईं ओर से डॉ. मनोज कुमार गुप्ता, डॉ. प्रवीण कुमार आत्रेय एवं आलोक बालाजी नचिकेता (R) बाईं ओर से योगेश दधीच, संध्या दवे, भूमि संदिप गज्जर, नितिन बैरागी एवं योगेश येवले।



श्री आलोक बालाजी नचिकेता ने इस नाटक की रचना की और इसका निर्देशन डॉ. प्रवीण कुमार आत्रेय, डॉ. मनोज कुमार गुप्ता एवं श्री आलोक बालाजी नचिकेता द्वारा किया गया। नाटक के अन्य कलाकार सुश्री भूमि संदिप गज्जर, श्री नितिन बैरागी, श्री योगेश योअले, श्री योगेश दधीच एवं डॉ. संध्या पी दवे ने तकनीकी, वेशभूषा एवं अन्य सहयोग प्रदान किया।



डॉ. आर. चिंदंबरम के कर कमलों से पुरस्कार प्राप्त करते हुए आईपीआर के प्रतिभागी

## राजभाषा के क्षेत्र में संस्थान की उपलब्धियाँ

परमाणु ऊर्जा विभाग का 20वाँ अखिल भारतीय सम्मेलन 15 नवम्बर, 2019 को परमाणु खनिज अन्वेषण एवं अनुसंधान निदेशालय, (एएमडी), हैदराबाद में आयोजित हुआ। इस अवसर पर परमाणु ऊर्जा विभाग द्वारा सरकारी कार्यों में राजभाषा के प्रचार-प्रसार को बढ़ावा देने के लिए आईपीआर को ये पुरस्कार प्रदान किये गये हैं: वर्ष 2018-19 के लिए पऊवि की सहायता प्राप्त संस्थान श्रेणी के अंतर्गत **राजभाषा शील्ड (उपविजेता)**, वर्ष 2018-19 के लिए पऊवि की सहायता प्राप्त संस्थान श्रेणी के अंतर्गत **“प्लाज्मा ज्योति” को सर्वश्रेष्ठ राजभाषा गृह पत्रिका पुरस्कार (विजेता)**। इस अवसर पर परमाणु ऊर्जा विभाग की यूनिटों/उपक्रमों/सहायता प्राप्त संस्थानों में से 9 पदाधिकारियों को हिंदी सेवी सम्मान के लिए चुना गया। हमारे संस्थान के **डॉ. प्रवीण कुमार आत्रेय, डीन (आर एंड डी)** तथा **श्री हरीश चन्द्र खण्डूरी, प्रशासनिक अधिकारी-1** को राजभाषा हिंदी के प्रचार-प्रसार में रचनात्मक एवं उत्कृष्ट योगदान देने के लिए परमाणु ऊर्जा विभाग द्वारा वर्ष 2018-19 के लिए **हिंदी सेवी सम्मान पुरस्कार** के लिए चयन किया गया एवं 20वें अखिल भारतीय सम्मेलन में स्मृति चिन्ह प्रदान कर सम्मानित किया गया है।



(L) श्री संजय कुमार शर्मा, संयुक्त सचिव (प्रशासन एवं लेखा), पऊवि के कर कमलों से राजभाषा शील्ड प्राप्त करते हुए आईपीआर की टीम (R) डॉ. दामोदर खड़से के कर कमलों से गृह पत्रिका पुरस्कार प्राप्त करते हुए आईपीआर की टीम।

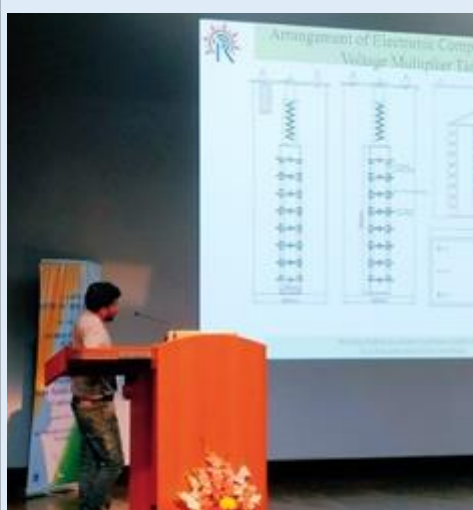


(L) श्री एम.बी.वर्मा, एएमडी, निदेशक से हिंदी सेवी सम्मान प्राप्त करते हुए श्री हरीश चन्द्र खण्डूरी (R) डॉ. प्रवीण कुमार आत्रेय की ओर से हिंदी सेवी सम्मान प्राप्त करते हुए श्री राज सिंह





(L-R) **Dr. S. R. Mohanty**, Associate Professor - F, and **Dr. S. S. Kausik**, SO-D, attended 14th Asia-Pacific Physics Conference (APPC14) held at Kuching, Sarawak, Malaysia, during 17-21 November, 2019. Dr. Mohanty delivered an invited talk entitled "*Basics of Inertial Electrostatic Confinement Fusion and its Application*" in Applied and Basic Plasma session of the conference. Dr. Kausik delivered an invited talk entitled "*Effect of cesium monolayer on tungsten particles in negative ion production*" at the same conference.



(L-R) **Shri Amal S.** gave an Oral presentation entitled "200kV, 15mA High Voltage DC Power Supply Characterization" and **Shri. Bharat Singh Rawat** (DGFS Engineering) presented a poster entitled "A Faraday cup array for the measurement of ion current density profiles for a gridded ion thruster" at the Indian Particle Accelerator Conference (InPAC- 2019), which was organized at the Inter-University Accelerator Centre (IUAC), New Delhi during November 18-21, 2019.



**Dr. Neelanjan Buzarbaruah**, PDF, gave an oral presentation entitled "*Interaction of Charged particles in an Inertial Electrostatic Confinement device*" at the 3rd Asia-Pacific Conference on Plasma Physics (AAPPs-DPP 2019) held at Hefei, China, during 4 – 8 November 2019.

## Installation of Basic Plasma Experiment System at Saurashtra University

IPR successfully completed a collaboration agreement with Saurashtra University, Rajkot entitled "**Development & Demonstration of Experimental Plasma Systems**". Under this agreement, a basic experimental plasma system for performing Paschen's curve and Langmuir probe diagnostics experiments for graduate and postgraduate level students was developed and installed at Department of Nanoscience and Advance Materials, Saurashtra University. From IPR, Dr. Mukesh Ranjan (PSED, IPR), Mr. Akshay Vaid (PSED, IPR), Mr. Sooraj K P (PSED, IPR) and Ms. Pramila (Electronics Group, IPR) contributed towards this work. Students and faculty members of from Department of Physics of the University attended the training program. As a part of the programme, Dr. Mukesh Ranjan gave a popular talk about plasma.





Plasma Trophy – 2019, an annual cricket tournament organized by the IPR staff club was held in the months of November and December 2019. Total 11 teams participated in the tournament, where, 25 matches were played in the league round of the tournament. The final match of the tournament, held on 22<sup>nd</sup> December 2019 between ITER India Fighters and Motera Indians, was won by ITER India Fighters by 9 wickets. Out of 8 plasma trophy tournaments organized till now, ITER-India fighter team has won this trophy 7 times.

|                       |                     |              |                                |
|-----------------------|---------------------|--------------|--------------------------------|
| Winning Team          | ITER India Fighters | Runner Up    | Motera Indians                 |
| Man of the Tournament | Kartik Patel        | Best Batsman | Mohit Jadon                    |
| Best Bowler           | Aditya Singh        | Best Fielder | Hardik Mistry and Kartik Mohan |



(L) Plasma Trophy Champions - 2019 (R) Player of the tournament Mr. Kartik Patel



(L) The winning and (R) runner up teams receiving their trophies



View of the final match in progress



- ♦ **Mr. Srimanta Maity**, Institute for Plasma Research, Gandhinagar, gave a talk on "*Molecular dynamics study of single particle and collective effects in dusty plasmas*" on 25th November 2019
- ♦ **Dr. Indranil Bandyopadhyay**, ITER-India, Institute for Plasma Research, Gandhinagar, gave a talk on "*International Tokamak Physics Activity (ITPA)*" on 29th November 2019
- ♦ **Dr. Basanta Kumar Parida**, Indian Institute of Technology Ropar, Punjab, gave a talk on "*Low energy ion beam nanopatterning of  $\text{Co}_x\text{Si}_{1-x}$  surfaces*" on 10th December 2019
- ♦ **Dr. Srinivasarao Bukkuru**, Andhra University, Visakhapatnam, gave a talk on "*Molecular Dynamics study of defect diffusion*" on 13th December 2019
- ♦ **Dr. Falguni G. Bhabhor**, Navjivan Science College, Dahod, Gujarat, gave a talk on "*Synthesis, Characterization and Biological Evaluation of Some Nitrogen Based Heterocyclic Compounds*" on 16th December 2019

### Upcoming Events

- ♦ Conference on Plasma Simulation (CPS), Institute for Plasma Research, Gandhinagar, 23-24 January 2020 <http://www.ipr.res.in/CPS-2020/>
- ♦ National Symposium for Commemorating 30-years of ADITYA Tokamak, Institute for Plasma Research, Gandhinagar, 27-28 January 2020 <http://www.ipr.res.in/Aditya30Years/index.html>
- ♦ Winter School Plasma Physics and Controlled Fusion, Saint Petersburg, Russia, 27 January 2020 to 7 February 2020 <https://www.fusenet.eu/node/1451>

### Know Our Colleagues



**Dr. Shwetang N. Pandya** joined IPR as Scientist - SC in 2003 with the Infrared Thermography Division. He did his M.Sc. (Physics) from Gujarat University in 2003. He worked as a JRF at SAC, ISRO before joining IPR. During service he earned his Ph.D. from the Graduate University for Advanced Studies (Sokendai), Japan in 2014. His area of expertise is thermal imaging. He has convened a couple of national workshops on thermal imaging and its applications in medical sciences and industry. He has contributed in the development of the thermal imaging diagnostics for the measurement of heat flux on the Plasma Facing Components (PFCs) and the diagnostic for the measurement of radiation from the plasma by the Infrared imaging Video Bolometer (IRVB) for Aditya, SST-1, Aditya-U and the Large Helical Device (Japan). He has also contributed towards using IR thermography for the Non-Destructive testing of the PFCs. He is responsible for the limiter flush Langmuir probe diagnostic installed on Aditya-U. Currently he is actively involved in the in-house development of the thermal imaging camera within IPR. He is a co-inventor of a patented diagnostic module called "DeLaS-IRIB" which stands for Deposited Layer Substrate - Infrared (IR) Imaging Bolometer. This is a radiation sensing module that addresses several inherent problems due to the ultra-thin metal foil in conventional IRVB. At present he is working as Scientific Officer – E.

**Dr. Santosh P. Pandya** joined IPR in 2005 as a Scientific Assistant in the plasma diagnostic division and worked on Charge Exchange Neutral Particle Analyzer (CX-NPA) for ADITYA tokamak and contributed to the first ion temperature measurements. He has also designed the Time of Flight (TOF) CX-NPA in 2007. He re-joined IPR as a Scientist - SC in 2008 with Infrared (IR) Thermography diagnostics division where he has designed and developed Infrared Imaging Video Bolometer (IRVB) diagnostic systems for the ADITYA and SST-1 tokamaks, development and measurements of the temperature of the Plasma Facing Components (PFCs) using IR-camera and estimation of impinging heat flux, heat diffusion length in ADITYA and SST-1, development and implementation of methods for the Non-Destructive Testing and Examination (NDT&E) of tokamak in-vessel components using IR thermography, development of several codes and synthetic diagnostics for data analysis as well as for modelling of diagnostic signals. He is a co-inventor of a patented diagnostic module called "DeLaS-IRIB" (Deposited Layer Substrate - Infrared (IR) Imaging Bolometer). He is also contributing in the design of ITER Hard X-ray Monitor for runaway electron detection since 2012. During his service, he earned his Ph.D. from the Aix Marseille University, France in 2019. His areas of expertise are; runaway electron modelling and diagnostics, thermal imaging, CX-NPAs and NDT&E. At present, he is working on the following projects: Fiber Optic Current Sensor, detection of runaway electrons using synchrotron emission, runaway electron modelling and contributing to the design of ITER Hard X-ray Monitor.



### 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 |