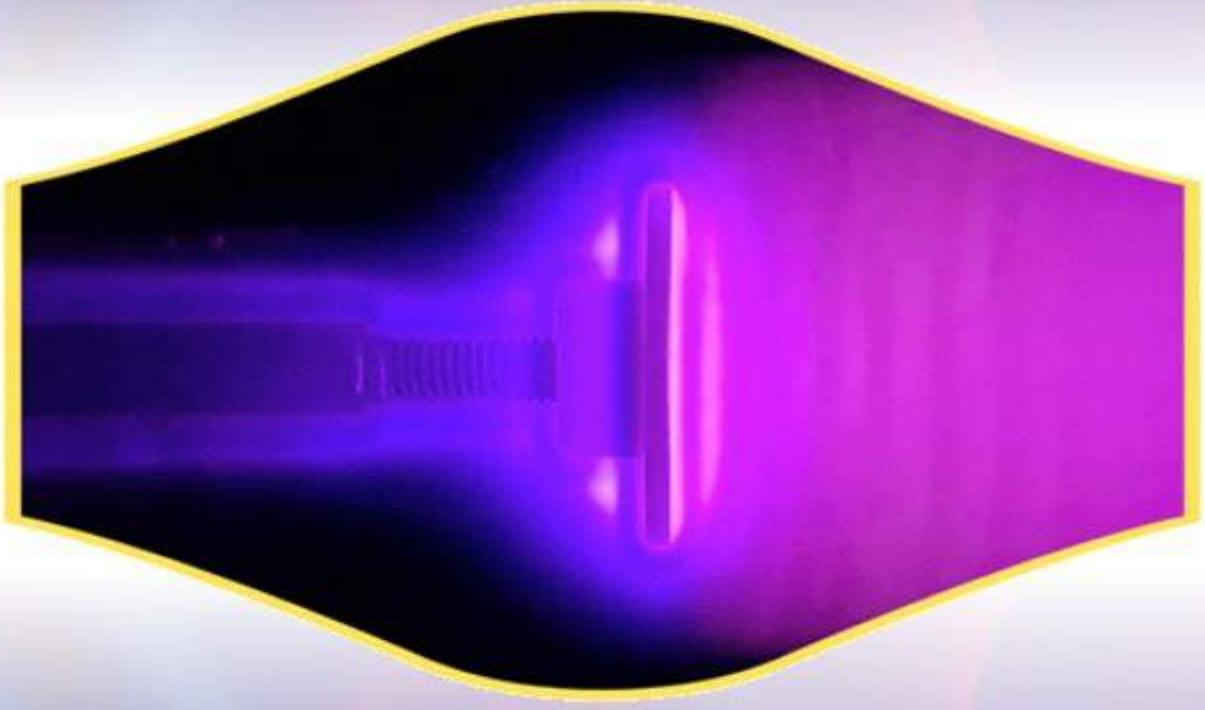
वार्षिक प्रतिवेदन
2023-2024

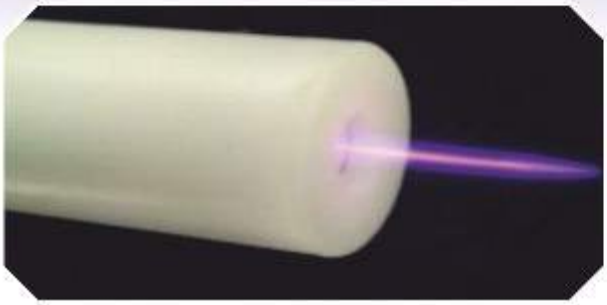
ANNUAL REPORT
2023-2024



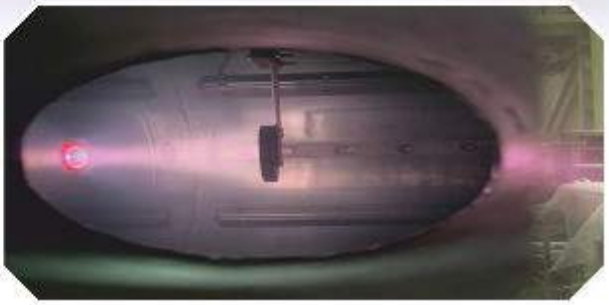
प्लाज़्मा अनुसंधान संस्थान
Institute for Plasma Research

भाट, निकट इन्दिरा पुल, गांधीनगर - 382 428, (गुजरात), भारत
Bhat, Near Indira Bridge, Gandhinagar 382 428, (Gujarat), India

आदित्य-अपग्रेड में ग्रेफाइट डायवर्टर टाइल्स के वेसल का भीतरी दृश्य
In-vessel view of graphite divertor tiles in Aditya-U



वायुमंडलीय प्लाज़्मा जेट से निकलता हुआ प्लाज़्मा जेट
Plasma jet coming out from the atmospheric plasma jet Thruster



थ्रस्टर चैंबर में मापा गया इलेक्ट्रॉन तापमान
Electron Temperature measured in Chamber

प्लाज़्मा कार्बुराइजिंग प्रणाली
Plasma carburizing system

ग्लो डिस्चार्ज प्लाज़्मा में स्ट्राइएशंस
On the cover page: Glow discharge plasma with striations

ANNUAL REPORT
2023-2024

प्लाज़्मा अनुसंधान संस्थान

Institute for **Plasma Research**

Bhat, Gandhinagar 382428

GOVERNING COUNCIL

1) Dr. A. K. Mohanty	Chairman
2) Shri. Vivek Bhasin	Member
3) Dr. Amit Roy	Member
4) Dr. Siraj Hasan	Member
5) Dr. Manjit Singh	Member
6) Dr. V. Narayanan	Member
7) Dr. S. Chaturvedi	Co-Chairman
8) Smt. Sushma Taishete	Member
9) Smt. Richa Bagla	Member
10) Shri. S. J. Haider	Member
11) Dr. P. Chaudhuri	Member
12) Shri. N. Vaishnaw	Non-Member Secretary

EXECUTIVE SUMMARY

The institute continued its quest towards indigenization with a variety of systems, technologies or knowhow either developed in-house, or in collaboration with various centers of excellence within India, the various units of DAE and Indian industries. The major thrust areas include a) societal applications of plasma based technologies b) upgrades and findings on tokamaks and their sub-systems c) experiments and theoretical aspects of fundamental plasma physics d) development of fusion technologies and e) International collaborations under ITER and LIGO mega-science projects.

In the area of Advanced Technologies and Applications, good progress has been made in (i) the development of a 5 TPD biomedical waste disposal plant (RAUDRA) based on plasma pyrolysis the foundation stone was laid at Varanasi by Hon'ble Prime Minister of India in Feb'24, ii) setting up of an ATAL incubation center at the instute and registration as "AIC-IPR Plasmatech Innovation Foundation", with processing of several Startup applications at an advanced stage; iii) Successful demonstration of a plasma-based air sterilizer system, iv) development of an antibacterial coating on polyester yarn using magnetron sputtering - a patent application has been submitted, v) successful testing of a 320 kW graphite electrode based plasma torch system for 16 hours with an electro-thermal efficiency of over 91%, vi) development of a microwave plasma system for sterilization of medical components, with a patent application submitted, vii) significant advancements in development of helicon plasma thruster technology, viii) commissioning of the SPIX-III facility at the instute for testing & validation of newly-designed satellite solar panels under realistic orbital conditions, ix) studies on thermal plasma jet for low pressure spraying applications, x) setting up of a NF_3 based RF glow discharge plasma etching facility, and xi) development & demonstration of a new microwave-driven plasma system for sterilization of heat sensitive medical equipment within 5-10 minutes.

A variety of upgrades on the ADITYA-U tokamak have permitted experiments in new regimes and first-time demonstration of some technologies on an Indian tokamak. Standard discharges with a plasma current of around 120 kA, lasting for 100-300 ms at a toroidal magnetic field of 1.07-1.28T, have been achieved. Localized wall cleaning by sweeping the ECR layer has been demonstrated. Another important development includes mitigation of runaway electrons using localized vertical magnrtic field perturbation, a critical area of research in the field of fusion worldwide. Additional studies include role of pinch in Argon impurity transport in ohmic discharges and investigation of temporal evolution of hard X-ray spectrum from Neon-seeded plasmas. A 500 V, 5 kA fast response bipolar power supply has been indigenously developed to enable tokamak plasma position control on millisecond time scales. Technology developments on the SST-1 Tokamak include an LN_2 phase separator, refurbishment of the 80 K vent return line to prevent loss of LN_2 during operation, replacement of the analog controller of the TF power supply with a new DSP recon controller and hardware-in-loop testing activities to develop plasma control modules. The LHCD system has been configured for its use both on ADITYA-U and SST-1 in future experimental campaigns, and the first-time use of a PAM antenna which allows better RF power coupling with a variable plasma. Plasma current in Aditya-U could be extended up to ~ 230ms and 430 ms with the PAM launcher, for tokamak operated with positive convertor and negative convertor respectively. Plasma diagnostics development includes fast visible imaging diagnostic for observation of tearing modes, use of twisted optical fiber based magneto optic current sensors, Michelson interferometer development, development of silicon carbide based high temperature black body calibration sources, design and characterization of a 16-channel intermediate frequency receiver, W-band trans-receiver sub-systems, an evaporative dump diagnostic for electron temperature measurements, neutral particle analyser based charge exchange diagnostics, soft X-ray diagnostic with provision for various filter thickness combinations and onsite

determination of effective turn-area of magnetic probes.

Significant progress was made in the area of development of indigenous fusion technologies. These include i) development and successful testing of 100 mm bore high temperature superconducting magnets producing a central magnetic field of 3.5T at 4.2 K for 360s with excellent cryostability for the first time in India, ii) development of an X-ray imaging set up to obtain cross sectional profile for 28 kW electron beam incident on tungsten target, iii) tungsten fiber reinforced tungsten material development, iv) development of high temperature brazing technique for joining tungsten to tungsten alloy (WL10) material suitable for fabricating helium cooled divertor targets for fusion reactors, iv) development of helium cooled target handling system for high heat flux facility, v) development of shear punch fixtures tested for tungsten targets at elevated temperatures upto 500^{o}C, vi) development of a permanent magnet based electromagnetic pump for high temperature heavy liquid metal applications, vii) development of LN_2 cooled cryopumps, installation of indigenously developed Agastya-500 sorption cryopump on SST-1 and development of Agastya 1250 cryopump for SAC-ISRO, viii) development of cryogenic twin-screw extruder system for producing hydrogen pellets at an extrusion rate of 200 mm^3/s, ix) first-time development of a device to measure emissivity of high roughness materials at 82 K, and x) successful development of remote handling and robotic technologies which include an articulated robotic inspection arm (ARIA), hyper redundant inspection system (HyRIS), haptic force feedback arm for maintenance and component handing inside tokamaks. In the area of negative ion beam development, the ROBIN test bed has been upgraded to perform neutral beam production experiments with 70% neutralization achieved in the preliminary experimental campaign. Progress on the accelerator based 14 MeV DT neutron facility has resulted in a maximum yield of 1.4 x 10^{12} n/s at 250 keV against the design value of 5 x 10^{12} n/s. Role of fast neutron irradiation in the structural modification of the Al_2O_3 samples has been studied where significant change in the insulation resistance of Al_2O_3 is observed.

There were major accomplishments in the area of basic plasma research. A world-record confinement time of 100s has been achieved on the SMARTEX-C non-neutral plasma device, which is an order of magnitude higher than that achieved elsewhere. The first ever experimental observation of non-equilibrium ‘triple point’ in strongly coupled plasmas has been made in a dusty plasma.

Extensive theoretical and simulation work has been performed in several areas related to nonlinear phenomena, tokamak and fusion reactor studies, fundamental plasma studies, laser plasma interactions and dusty and complex plasmas.

On the international front, significant progress continues in both Mega-Science projects, viz., ITER and LIGO. ITER-India continued delivery of in-kind packages to the ITER project as per schedule. Progress at ITER India relates to completion of manufacturing and assembly activities on the torus cryo pump housing system, continued integration and testing of the cryolines and warmlines at different ITER locations, completion of manufacturing, acceptance tests and shipping of 3 out of 5 auxiliary cold boxes, restart of operations on the gyrotron testing facility after upgrades based on the lessons learnt during the 1st operational phase, RF power testing of several of the indigenously manufactured components for the IC system, initiation of the assembly of the DNB beam source and arrival of the beam line components of the DNB at INTF test bed, successful repeated and stable operation of the indigenously developed PSM topology based Main High Voltage (55kV, 6MW) Power Supply (MHVPS) for the Gyrotron test facility and developments related to various diagnostics for ITER. HR development has been initiated by a successful collaboration between IPR research scholars and scientists with their counterparts in the ITER Organisation Physics and modelling group and also through collaborations on the neutral beam test facility at RFX, Padua. Progress in the LIGO India project relates to

integration of a 20 m long vacuum vessel at the IPR LIGO laboratory, progress in testing of the 80 K cry-opumps at the factory and prototyping activities to ensure the development of the control and data acquisition for the facility.

Six Patents have been granted during the course of this year and relate to i) A Wideband Hybrid High Power MW Level CW Radio Frequency (RF) Combiner / Splitter, ii) MW Level CW Single Pole Double Throw (SPDT) Coaxial Radio Frequency (RF) Switch, iii) An Apparatus for Water Treatment to Activate Water Using Atmospheric Pressure Hybrid Plasma System, iv) A Method for increasing the life of Cutting Tools, v) Atmospheric pressure plasma jet for bio-medical applications, vi) A method for the realization of dense isotropic h-boron nitride and its silica composite' has been Granted by Indian Patent Office jointly to VSSC and the instute.

In addition, outreach activities continue to cover a large spectrum of schools, college &, institutes, including training programs for teachers. The institute's exhibition stall won the "Best Innovation Exhibit" award at the Science Carnival 2023 organized by the Gujarat Government.

DIRECTOR,
IPR.

ANNUAL REPORT

APRIL 2023 TO MARCH 2024

Considering fusion as an alternative source of energy, the Institute had initiated a programme to study magnetically confined high temperature plasmas in 1984 and built India's first tokamak ADITYA in 1989. Nearly a decade later a steady state tokamak, SST-1 using superconducting magnets is also constructed. Since the inception, the institute has been involved not only on fusion plasma R&D activities but also various plasma physics related fundamental research and its technology developments to address many industrial and societal challenges. To meet large scale computer based design and analysis requirements a High Performance Computing (HPC) facility along with a high capacity GPU cluster has also been established capable of handling 100kW of IT load. Over these years, the institute has trained a large number of man power to pave the way to reach India's "Self-reliant/Atmanirbhar - Vikshit Bharat" goal in the field of plasma science, technology and fusion power. Institute is involved in two international mega science projects, ITER and LIGO; where highly advanced state-of-the-art devices/components to be delivered as in-kind contributions. Many of such technologically challenging items are already delivered successfully. Institute is internationally recognized for its contributions to fundamental as well as applied research in plasma physics and associated technologies.

CHAPTERS

CHAPTER A

SUMMARY OF SCIENTIFIC & TECHNICAL PROGRAMMES

A.1 Plasma Based Technologies & Applications

Plasma based technologies and applications is a key area with far reaching technological and societal benefits. New projects in these areas have been added and good progress continues. major The highlights of the current year are being detailed in the following subsections

A.1.1 Plasma Surface Engineering Applications

Development of Plasma Based Air Sterilizer with C-CAMP: An atmospheric pressure plasma based air sterilizer has been developed & optimized jointly with C-CAMP (Center for Cellular & Molecular Platforms) (Figure A.1.1). It has shown an efficiency of 99% in the disinfection of several classes of bacteria, fungi and viruses. This could be used for large scale deployment in public transport. Experiments on an AC bus of 17-seater capacity using our device showed that this device could disinfect the microorganisms in the bus with 2 log reduction.

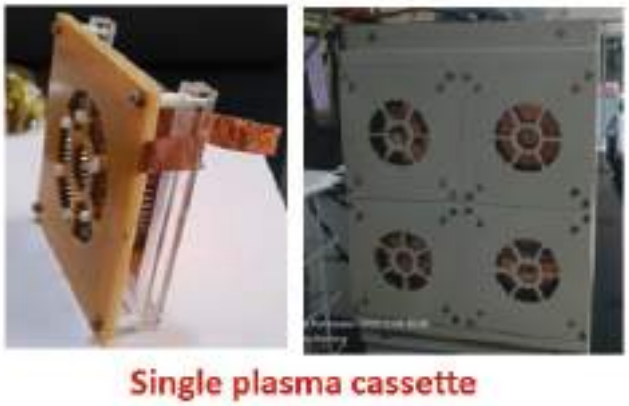


Figure A.1.1: Actual photograph of C-CAMP sterilizer.

Antibacterial Coating on Polyester Yarn Using Plasma Based Cylindrical Magnetron Sputtering: An antibacterial coating of copper oxide, few 10's of nm thick, has been deposited on polyester yarn using cylindrical magnetron sputtering (Figure A.1.2). The copper oxide coating has been tested for its composition, morphology and antibacterial efficacy. It has also been tested for bacterial growth and shows no growth of Staphylococcus Aureus and Escherichia Coli bacteria.

Figure A.1.2: Images of uncoated and copper oxide coated yarn.

Graded Oxide Layer for High-Performing Nano-sized Synaptic Emulator: The neural network in a human brain sees neurons connected via synapses to perform several functions related to our daily lives. An analogy to this is the electrons allowing for data storage and computation to be performed using a single device and is referred to as Neuro-

morphic computing. This requires development of an artificial synapse. As continuation of the plasma fireball mediated ion implantation activities for nanosized synaptic emulators, 10^6 number of synapses arrays of 20 μm x 20 μm and 5 x 10^{11} arrays of 6 μm x 6 μm size over a 3' wafer have been developed. The demonstration of synaptic weight reversal in the advanced Bienenstock-Cooper-Munro (BCM) learning rule is a key finding of this work. The same has been established using input voltage pulses of different frequencies applied to the device keeping fixed amplitude and width for each pulse to mimic the BCM rule. It is clearly observed that the rate of synaptic weight change is positive for the first two sets of pulses. However, the synaptic weight for the last set of pulses becomes negative (Figure A.1.3). The realization of the reversal of synaptic weight from positive to negative is crucial to explain the bio-brain learning and forgetting behaviors, where the after-effect of forgetting and learning competitive actions decide the actual functioning of the device.

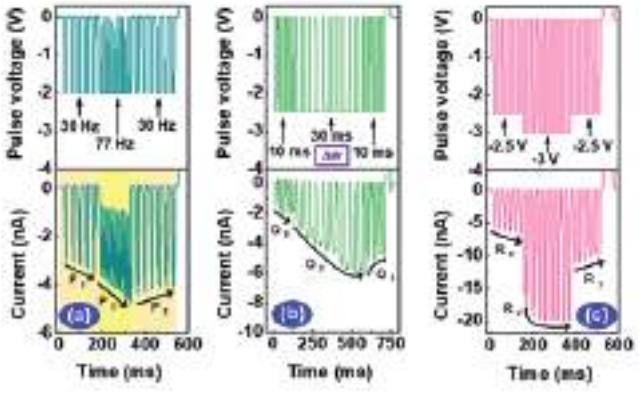


Figure A.1.3: Demonstration of Bienenstock-Cooper-Munro (BCM) learning rule at the nanoscale in TiOx-based single-layer (graded oxygen) memristors. Facilitation and depression are noted in response current for a train of identical input pulses depending upon the device's history. Observation of synaptic weight (I2-I1/I1) changes from positive to negative for identical voltage pulses by introducing pulses of larger (a) frequency, (b) width, and (c) amplitude. I1 and I2 are the response current amplitude for the first and second input voltage pulses respectively.

Plasma Surface Modification of Silicone Catheter Surfaces for Reduction of Bacterial Adhesion: A plasma process has been established to modify Silicon Catheter surface by optimizing two important process parameters, namely plasma exposure time and RF power to acquire minimum bacterial adhesion on to catheter surfaces. Results reveal that surface morphological changes on catheter surface play significant role in reduced bacterial adhesion as well as in mitigation of problem of bio-film formation. Bacterial adhesion is found to decrease gradually as the surface properties evolve as a function of RF power. Mitigation of bacterial adhesion and biofilm formation on plasma treated silicone catheter surfaces have been validated for uro-pathogens namely E-Coli and P. Aeruginosa.

Development of Plasma Immersion Ion Implantation System (PIII) Facility: Installation and commissioning of a prototype low energy (up to 20 keV) Plasma Immersion Ion Implantation (PIII) system has been completed successfully. This includes compatible experimental chamber, 1 kW RF (13.56 MHz) generator with automatic matching network, and a high voltage (up to 20 kV) negative pulsed DC power supply (Figure A.1.4). The integrated system was tested for its regular operation. This facility is meant to study the implantation of nitrogen ions in Aluminium and its alloys with the objective of improving their tribological and corrosion properties.

MOU Agreement Template of Surface Enhanced Raman Scattering (SERS) \Based Sensing: Institute has signed an MoU agreement with M/s. Lab-India, Mumbai for the template of Surface Enhanced

Raman Scattering (SERS) based sensing (Figure A.1.5). The developed SERS templates has the capability to detect various molecules under very low concentrations and has been tested for various food adulterants. Under the MoU, SERS template will be tested for various industry relevant molecules.

Figure A.1.4: Photographs of the PIII system (a) Vacuum compatible experimental chamber (b) High Voltage negative pulsed power supply and (c) 1000W RF generator with automatic matching network.

Figure A.1.5: MoU signed between the Institute and M/s Lab India, Mumbai for SERS Nanopatterns.

<u>*Comparative Wettability Study of Bulk and Thin Film of Polytetrafluoroethylene after Low Energy Ion Irradiation:*</u> While keeping in mind the wide range of applications of bulk PTFE and PTFE thin films, a detailed investigation and a comparative study of surface morphology, wettability, and chemical composition of PTFE and their thin films after ion irradiation are required (Figure A.1.6). Commercially available bulk PTFE sheets and PVD-grown PTFE-like thin films, having similar initial contact angles, have been used to study the wetting dynamics. Both the surfaces were irradiated with low energy ion beam having beam energy of 800 eV, at an angle of incidence from 0° to 70°. The surface morphology of irradiated surfaces was investigated using a scanning electron microscope (SEM). Wettability studies were carried out by measuring the water contact angle from the parallel as well as perpendicular position to the ion beam direction. Large difference in surfaces and in water contact angle of bulk and thin film of PTFE was observed after plasma treatment.

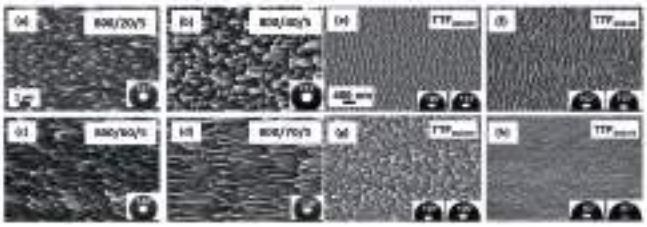


Figure A.1.6: Surface morphology of PTFE sheets (a-d) and PTFE-like thin films (e-h) after ion beam irradiation at a different angle of incidence. The angle of incidence (α) varied as 20° (a, e), 40° (b, f), 60° (c, g), and 70° (d, h), respectively.

<u>*Installation and Commissioning of Plasma Carburizing System:*</u> Institute has installed a High-Temperature Vacuum Furnace with a High-Pressure Gas Quenching System in December 2023 to develop a plasma carburizing process (Figure A.1.7). The system can carburize ~ 500 kg load. The system comprises a working volume of 900 mm deep and 600 mm in height. The plasma carburizing process is an environment-friendly process to provide a uniform surface hardening treatment of components with complex geometry. The plasma carburizing process delivers the component with minimum or no distortion as compared to other processes. Plasma carburizing is suitable

for material like EN36C, EN8, EN16, 17CrNiMo$_{6,}$ SAE8620, 20MnCr$_5$, 20CrNi$_4$, EN353 and EN354. Industries which can be benefited by plasma carburizing process are aerospace, automobile, manufacturing, rail and tool & die industries.

Figure A.1.7: Plasma carburizing system.

A.1.2 Atmospheric Plasma Applications

Foundation Stone Laying Ceremony by Hon'ble Prime Minister for Setting up of Common Biomedical Waste Disposal Plant at Varanasi: On 23rd February 2024, Hon'ble Prime Minister laid the foundation stone for setting up of common biomedical waste treatment facility (CBWTF) at Ramana, Varanasi. In this facility, a 5 tons per day (TPD) plasma pyrolysis plant (RAUDRA) - which is indigenously designed & developed by the institute will be used for disposing yellow category biomedical waste (Figure A.1.8). The essential equipment & machineries required for CBWTF to treat other categories of biomedical waste, as per CPCB norms, will also installed. The site development and shed construction is under progress through CPWD, Varanasi. This facility will cater to various hospitals and health care facilities located in and around Varanasi to treat and dispose their biomedical waste in an environment friendly manner.

Figure A.1.8: Foundation stone laid by Honourable Prime Minister Shri Narendra Modi. Right: Dr. Shashank Chaturvedi (Director, IPR), Dr. S. K. Nema along with other officials during the stone laying ceremony.

Studies on Thermal Plasma Jet for Low Pressure Plasma Spraying Applications: Very Low Pressure Plasma Spraying (VLPPS) is an emerging technique that is capable of forming functionalized coatings with controlled micro-structures (Figure A.1.9). The technique is cost effective and non-line-of-sight, bridging the gap between conventional spray and PVD. It has great potential in the aerospace industry where complex aerofoil structures or turbine blades require thick Thermal Barrier Coatings (TBC) and also in the solid oxide fuel cell (SOFC) industry requiring gas tight coatings, a mixture of condensed vapours and splats. A state-of-the-art VLPPS system has been set up at the institutes FCIPT center. The low pressure, thermal, supersonic plasma jet has been characterized using electrical diagnostics, fast imaging and spectroscopy. Besides an investigation of the subsonic to supersonic transition of the jet a semi-empirical relationship has also been established to enable the scale-up to higher powers to suit industrial applications.

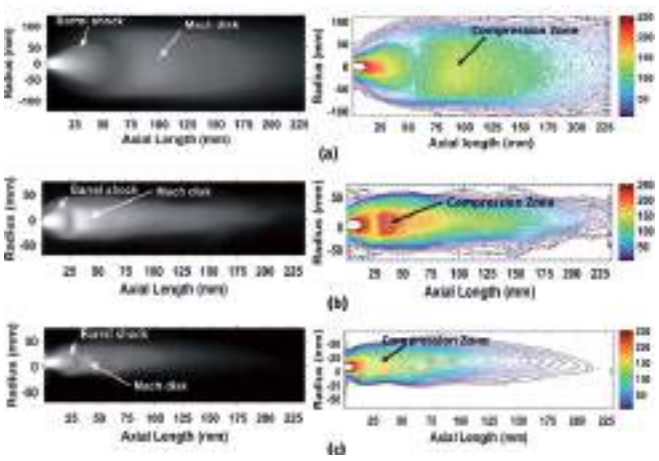


Figure A.1.9: Evolution of plasma jet images and their respective iso-contour profile for 50 LPM N_2 flow rate and 500 A at (a) 1 mbar (b) 10 mbar and (c) 30 mbar chamber pressure.

The investigations also involved exploring the jet phenomenology, shock structure and variation with ambient chamber pressure. High-speed imaging has unraveled the transition of the under-expanded plasma jet from a continuum regime to a frozen state, with implications for energy transfer during spraying. 100 micron thick thermal barrier coatings (TBC) at the rate of 10–20 micron/min were demonstrated using this technique.

Successful Testing of 320 kW Graphite Electrode Based Plasma Torch System for 16 Hours: A 320 kW graphite electrode based plasma torch system has been successfully tested for 16 hours operation (Figure A.1.10). The power supply of this plasma torch system has also been tested successfully on a resistive load bank for 24 hours at full load. The electro-thermal efficiency of graphite electrodes-based plasma torch system was observed to be 91.6% which is much higher than the conventionally used metal electrode based water-cooled plasma torch system. The graphite electrodes are consumables due to erosion. The erosion rate of graphite electrodes was observed to be 25 mm per hour for two anode electrodes and 50 mm per hour for one cathode electrode during this testing, at power levels ranging between 250 kW & 320 kW.

Development of Microwave Plasma System for Sterilization of Medical Components: A new microwave source based plasma system and process for sterilization of medical components and devices has been developed (Figure A.1.11). The system overcomes several limitations of conventional technologies and is able to achieve sterilization at room temperatures within few minutes of exposure to plasma. Several bio-trials have been conducted

Figure A.1.10: a-Red hot electrode and chamber; b- Control Panel; c – Power supply unit; d – Plasma torch test system comprising electrodes and chamber.

to investigate the underlying mechanisms and biochemical actions that lead to the killing of microorganisms and interesting results have emerged both at cellular and genetic levels. It has been observed that plasma exposure has detrimental effects on essential biomolecules responsible for functioning of cells. A patent application has been submitted for this system and process developed by the institute.

Figure A.1.11: Medical components being sterilized inside microwave plasma inside the sterilization system.

<u>*Batch Production of Tungsten-Copper Electrodes for Plasma Torch:*</u> Batch production of total 18 numbers of Tungsten-Copper Electrodes (Figure A.1.12), used as consumable in thermal plasma spray equipment, has been completed. This opens the way for commercialization.

<u>*Development of Non-equilibrium Atmospheric Plasma Jet for Effective Sterilization and Biological Safety:*</u> A BRNS project titled 'Exploring non-equilibrium atmospheric plasma for effective sterilization and biological safety' (Figure A.1.13a & A.1.13b) has been successfully completed in collaboration with Nirma University, Ahmedabad.

Figure A.1.12: Tungsten – Copper electrodes for plasma torch.

Figure A.1.13: (a) Plasma jet set up (b) Plasma jet coming out from the atmospheric plasma jet.

The main objectives of the project were to study the sterilization potential of atmospheric plasma against various microorganisms and to evaluate the safety aspect of atmospheric plasma on cell lines and in animal models. Various organisms such as S.Aureus, B. Subtilis, E.Coli, P.Aeruginosa were tested for the sterilization and a 6 log reduction in these microorganisms were achieved after a treatment of 5 minutes. In this study, the effect of atmospheric pressure plasma jet on animal models (mice) was also studied and no harmful effect has been found on the animals.

<u>*Supply of Atmospheric Pressure Plasma Jet (APPJ) to Birla Institute of Technology Mesra, Jaipur for Educational and Research Purposes:*</u> The APPJ has applications in the field of polymeric surface modification, reactive chemistry, bacterial and bi-

omolecule inactivation, wound healing and other biomedical applications. In one of the externally funded project, institute has developed and installed a plasma jet at BIT Mesra, Jaipur (Figure A.1.14). The system will be used to study the characteristics of the plasma produced by the APPJ by using optical and electrical diagnostics. This plasma jet can be operated using helium and argon gas where plasma plume length will be 20-30 mm.

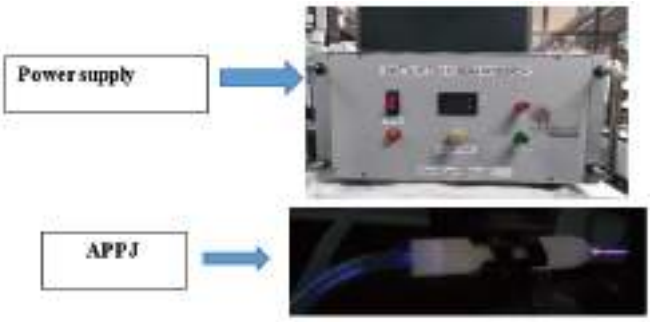


Figure A.1.14: The Atmospheric pressure plasma jet and power supply.

Plasma Treatment of Dye Solution: Experimental studies on degradation of Methylene Blue (MB) dye through treatment with an atmospheric pressure glow discharge plasma have been performed. Experimental results show that the degradation of dye increased with plasma current and treatment time. Polarities of the electrodes also have an effect in that the liquid cathode mode has higher degradation efficiency than liquid anode mode. Interestingly, it was found that anodic dissolution of copper electrode aids in degradation of MB dye by initiating Fenton like reactions involving copper ions, which was absent in the case of stainless steel electrode. The maximum degradation efficiency and COD removal rate achieved was 77% and 74% respectively, while the degradation yield obtained was 0.32 g/kW.h.

A.1.3 Plasma Thruster Technologies

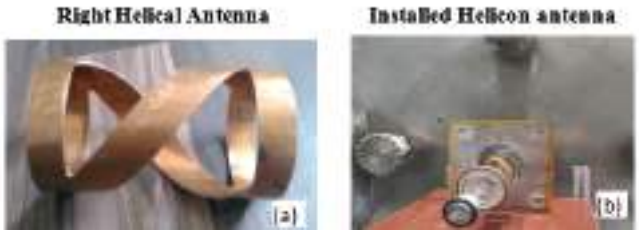


Figure A.1.15: (a) Right helical antenna and (b) installed helicon source and H-antenna.

A Helicon Thruster experiment at the institute has been upgraded with needed auxiliary units like plasma source quartz tube, permanent magnet system and a new calibrated thrust sensor. The thrust sensor, which is Strain-gauge based, has been calibrated up to the range 300 mN - 1N for use in higher-power experiments. Right helical antenna has been fabricated and installed on the large thruster system (Figure A.1.15). Plasma source tube, with appropriate vacuum feed through, for the plasma production has also been installed. The details are shown in figure A.1.16.

Figure A.1.16: Large Helical Thruster System with installed plasma source, helicon antenna.

In order to measure the thrust generated in the expansion on vacuum chamber, a thrust sensor with an axial translation feasibility has been installed in the axial plane of the plasma expansion at flexible distance from the magnetic nozzle. It is essential to have better understanding of various phenomena like plasma production, magnetic nozzle accelera-

tion and detachment physics for the generation of thrust.

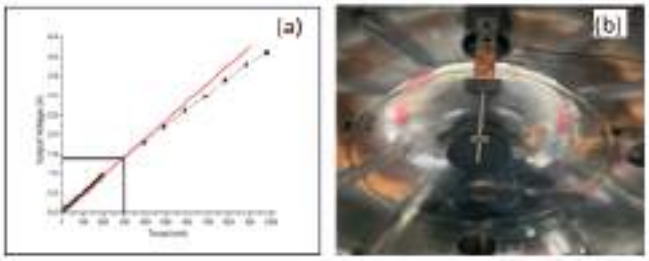


Figure A.1.17: Thrust sensor installed in large thruster system.

The diagnostics employed at the facility include; Langmuir probes for electron density and temperature, Mach probe for plasma flow velocity and optical emission spectroscopy (OES) for electron temperature measurements.

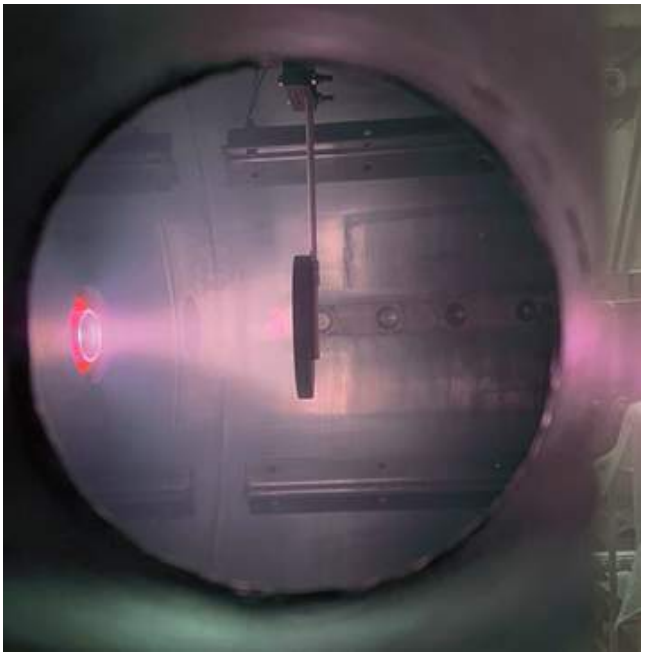


Figure A.1.18: Electron temperature measured in thruster chamber.

A B-dot probe (3D) was employed to detect the helicon waves in the expansion region. Variation of plasma parameters has been studied with variations in RF power & Ar gas pressure. Langmuir probes estimated the plasma density in range of $1x10^{12}$ cm^{-3} to $4x10^{13}$ cm^{-3} in the expansion chamber and electron temperature in range of 1-6 eV (Figure A.1.18). Mach probe with up-down configuration was employed and measured flow velocities in range of 4.5 km/s to 7 km/s which correspond to Mach numbers in range of ~ 1.3 to 2.1 indicating supersonic flows. OES was employed near to Helicon antenna and Ar lines intensity was measured in both blue and red regions. Further to measure thrust, a calibrated strain gauge based sensor was installed and experiments are under way with necessary optimization (Figure A.1.19).

Figure A.1.19: Thrust sensor with plasma plume in thruster chamber.

A.1.4 Other Technologies

Spacecraft Plasma Interaction Experiments - SPIX-III: Taking cognizance of the encouraging experimental findings of SPIX-II test facility in the previous years, the facility has been further upgraded to SPIX-III test facility (Figure A.1.20). The facility will be used to test and validate newly designed satellite solar panels developed by the U.R. Rao Satellite Centre, ISRO Bengaluru.

Figure A.1.20: Final acceptance of the augmented SPIX III facility by the URSC officials.

Studies on Nano Materials: Trial experiments were carried out in the existing system to optimise it for higher nano-powder production. The trials included running the experiment for higher arc current upto 300A. The effect of cathode geometry on the erosion rate was also studied with the objective of minimising erosion. Cathode cooling efficiency was also analysed and required changes incorporated.

Magnetic Nanoparticles: Magnetic nanoparticles were synthesised under various process parameters including current, ambient gases, and also preparation of nanoparticles under the influence of external magnetic field with a strength of upto 120 G. The results indicate a decrease in particle size. The magnetic property study also indicates an increase in the saturation magnetization and a decrease in the coercivity – both of which are conducive to achieve super-paramagnetic materials.

NF_3 RF Glow Discharge Plasma Etching Facility: A Facility of NF_3 RF glow plasma discharge is developed using a 13.56 MHz radio-frequency (RF) source (Figure A.1.21). In this plasma etching system, the substrate is placed in a vacuum chamber on the powered electrode connected to the RF generator and gases are introduced to produce the plasma. NF_3 gas plasma generates many Fluorine atoms (free radicals), which are highly reactive and spontaneously react with the substrate (Si) to produce volatile product (SiF_4) which is subsequently pumped away by the vacuum pump. Plasma etching of silicon wafers has been carried out. An etch rate of 1.5 micron/min is observed. Pristine silicon sample etched in the facility has been also characterized by the Scanning Electron Microscope (SEM). Figure A.1.22 (a) & (b) show the SEM im-

Figure A.1.21: NF_3 RF glow discharge plasma etching facility.

ages of the etched and pristine sample respectively. Figure A.1.22 (c) & (d) are cross section SEM images of the silicon wafer which confirms the etched rate of the 1.5 micron/min in the silicon wafer.

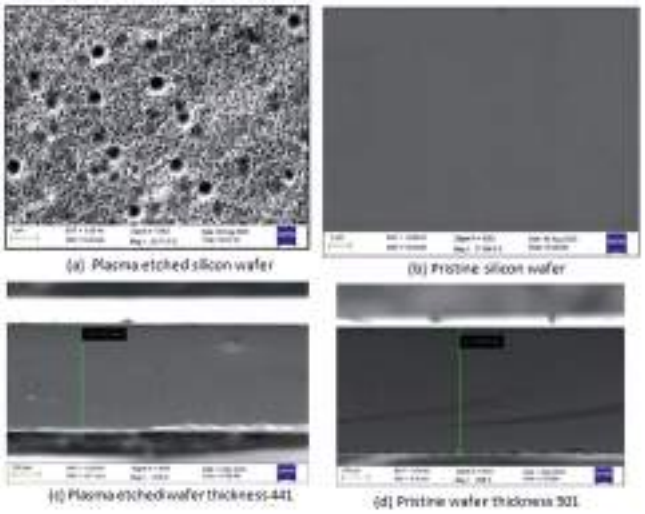


Figure A.1.22: SEM images of the Plasma etched silicon wafer and pristine silicon wafer.

Plasma Based Stealth Technology: The reduction and control of Radar Cross-section (RCS) of an object have been attempted by various techniques, including shaping, use of radar absorbing materials, frequency selective surfaces, engineered materials etc. Plasma based RCS reduction is a technique that is associated with the reflection and absorption of incident EM wave by the plasma layer surrounding the structure whose RCS is to be reduced. This technique is particularly promising because of its wider frequency band of absorption, selective reduction in RCS because of the electron density control and also because there is no alteration in the shape of the target. Figure A.1.23 shows the rectangular and elliptical tiles developed at the institute for the purpose. Plasma Chambers arranged in array are used to produce plasma of appropriate parameters. The experiment to study the absorption of microwave using this technique was carried out in an anechoic chamber, designed and developed at the institute and also in the outside environment to simulate real-life situations (Figure A.1.24). It is observed that the RCS of the metal target is reduced substantially with the introduction of plasma panels of different shapes.

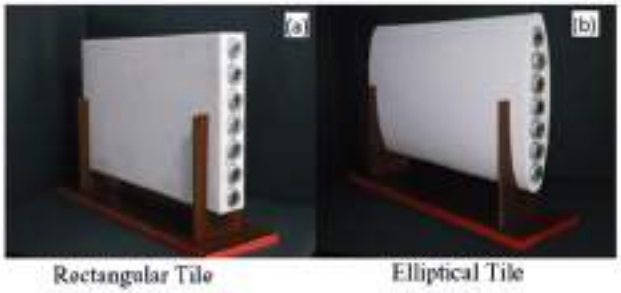


Figure A.1.23: Rectangular (a) and elliptical (b) tiles used in the RCS experiment.

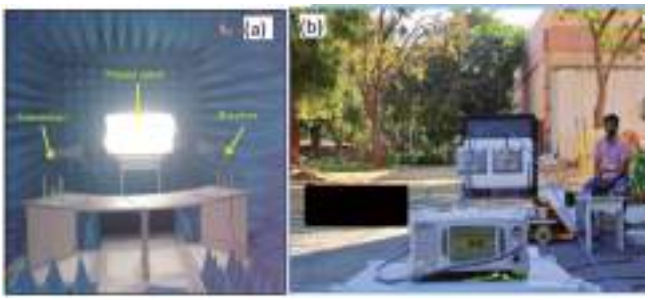


Figure A.1.24: RCS reduction experiment in anechoic (a) chamber and RCS reduction experiment in outside environment (b).

A1.5 External Projects

A) PROJECTS COMPLETED				
Sr. No	**Organisation**	**Description**	**Deliverables**	**Status**
01	ITER Organization	Radiation calculations support for penetration working groups (additional scope)	Report on radiation calculations for Nuclear analysis for local shielding	Calculations and analysis as per the scope completed. Final reports have been delivered to ITER Organization.
02	Gujtex Engineering Company	Supply of 25 kW Graphite Electrode based plasma torch assembly	Supply of graphite based electrode system for 25 kW capacity	The scope of original order completed. The plasma torch system has already been delivered. Subsequent to this, the additional scope of work was proposed by the party and the same is under execution.
B) PROJECTS STARTED				
Sr. No	**Organisation**	**Description**	**Deliverables**	**Status**
01	Excel Industries	Technical consultancy for setting up 75 kW thermal plasma system	Providing technical consultancy on advisory basis	GA drawings of the system are finalized and detailed specifications are being worked out.
02	Birla Institute of Technology (BIT), Mesra Jaipur campus	Supply of Atmospheric Pressure plasma jet	Atmospheric pressure plasma jet system	The system has been fabricated and delivered to BIT Mesra
03	Space Application Center (SAC), ISRO	Development and supply of 1250 mm aperture sized, Liquid Nitrogen cooled cryopump (AGATSYA™)	1250 mm aperture sized liquid nitrogen cooled cryopump (AGATSYA™)	Engineering design completed. Purchase order placed for fabrication of vessel.
04	Sun Petrochemicals Private Limited	Feasibility study for Automatic Wire Explosion system for enhanced oil recovery	Feasibility study report	The final design of the mechanical tool and completed. The specifications of all components of electrical system with specific dimensions have

				been worked out. Specific wire feeder assembly is designed to perform in the stringent operating conditions below the earth surface.
05	Vedanta Aluminium and Power	Feasibility study for synthesis of Ti_3AIC_2 MAX phase material and its coating on Carbon material	Feasibility study report along with coated samples	The coating of nickel, Titanium and Ti_3AlC_2 on carbon samples were attempted using various techniques such as HVOF, laser cladding etc. The coated samples and final report submitted.

C) TECHNOLOGY TRANSFER AGREEMENTS EXECUTED

Sr No	Name of Organization	Technology	Executed on
01	Bhakti Energy	Technology transfer for Plasma pyrolysis technology for disposal of Bio-medical waste (RAUDRA™)	Technology transfer agreement was executed on 10th July,2023
02	Sun Vacuum and Plasma Engineering	Technology transfer for Glow discharge system along with Langmuir probe diagnostics	Technology transfer agreement was executed on 15th December, 2023

D) MOU/COLLABORATION AGREEMENTS EXECUTED WITH EXTERNAL AGENCIES

Sr No.	Name of Organization	Title	Executed on
01	ICAR- Central Sheep and Wool Research Institute	Development of anti-shrink wool fiber and fabrics using plasma processing	10th April, 2023
02	Bhukhanvala Industries Private Limited	Collaboration on sharing of knowhow and expertise related	30th May,2023

		to ceramic materials for Tokamak systems and plasma technologies.	
03	Bellatrix Aerospace	Collaboration on sharing of knowhow and expertise related to plasma technologies for space sector	08th June, 2023
04	Narsinhbhai Patel Dental College and Hospital, Sankalchand Patel University	Collaboration agreement for sharing of know-how and intellectual property rights for use of plasma activate water as a storage medium for avulsed tooth	31st January,2024

A.1.6. ATAL Incubation Centre

In order to provide thrust to “Make In India” campaign of Government of India, and to provide support to the deep-tech start-ups and innovators of India, the Department of Atomic Energy (DAE) had announced the establishment of Incubation Centers in several organizations including our institute in October 2020. Subsequently, institute had submitted a proposal to NITI Aayog for obtaining the recognition as Atal Incubation Centre (AIC) which was approved by AIM-NITI Aayog. Under this initiative, the AIC is to be funded by the Atal Innovation Mission (AIM) of NITI Aayog for a period of five years, in accordance with AIM's provisions and guidelines for incubators.

As per the compliance requirements from NITI Aayog and the approvals accorded by DAE, Institute has registered its incubation centre as "AIC - IPR Plasmatech Innovation Foundation" (“AIC-IPR”), as a not-for-profit company under section - 8 of the companies act 2013. The Governing Council of the instute has also accorded its approval to utilize the AIC-IPR as a commercialization wing of the institute which will not just incubate tech-based startups, but will also facilitate execution of externally sponsored projects and technology transfer to industries. Subsequent to the registration of the company, the compliance documents sought by AIM-NITI Aayog were submitted to AIM. The registration process for GST certification, PAN and TAN has also been completed. The first board meeting was recorded and the minutes have been compiled in consultation with the Company Secretary. The compliance activities are being undertaken to comply with companies act 2013 and the board expansion process is underway. A CAG nominated auditor has been appointed to conduct the audit for the FY 23-24. Subsequent to the registration of the AIC, 4 startups were shortlisted and their incubation agreement drafts are under finalization. Meanwhile, matters related to website development, recruitment of staff, setting up of office are in pipeline.

A.2 Fundamental Plasma Physics

Studies of fundamental plasmas occuring naturally occurring whether in laboratory, in earth's magnosphereplasma or solar environment of our universe is of great interest still to the plasma community because of their dynamicity and interaction with us directly or indirectly in our day to day life. Plasma created in laboratories is characterised under various experimental conditions to explore its fundamental nature and proprieties which not only lead to a better understanding of the various areas of physics interest but also can be exploited for several applications of importance to the society,industry and power plants. The following section describes experimental devices at the institute.

A.2.1 Large Volume Plasma Device (LVPD) – Upgrade

A large multi-filamentary plasma source in LVPD-U has been characterized for different strength of magnetic field screen produced by electron energy filter (EEF), recently installed in the axial center of LVPD-U. Various plasma parameters viz., plasma density, electron temperature, floating and plasma potentials and their fluctuations are investigated to identify the excited turbulence and the associated free energy source. It is observed that source plasma region, almost free of radial gradients, is the suitable region for carrying out linear and nonlinear studies of active electromagnetic whistlers and whistler induced turbulence. For pursuing active whistler investigations in a large null region, a Helmholtz coil has been constructed in LVPD-U. A loop antenna is used as an exciter.

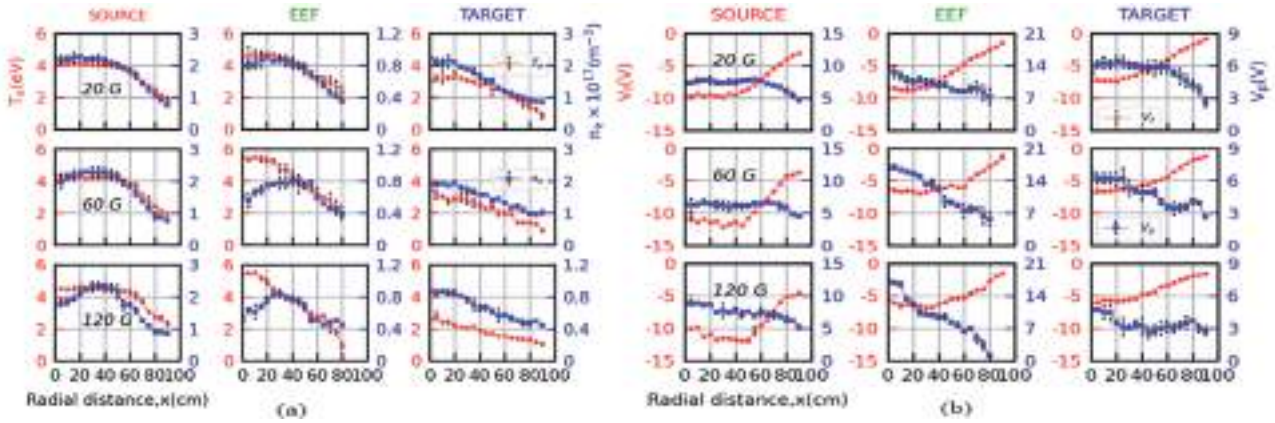


Figure A.2.1: (a) Spatial evolution of electron temperature (T_e), plasma density (n_e) are shown and (b) floating potential (V_f) and plasma potential (V_P).

The plasma characterization in the target region has been completed for different strengths of magnetic field screen produced by EEF. The radial profiles of plasma density, electron temperature are shown in figure A.2.1 (a) and floating and plasma potential in figure A.2.1 (b) respectively. The propagation is shown in figure A.2.2.

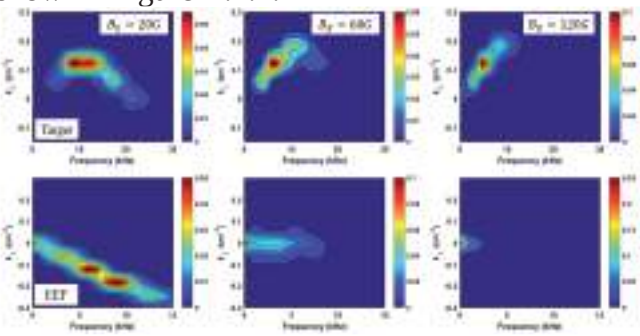


Figure A.2.2: The contour plots of wave-number frequency power spectral density at target and EEF plasma for B_X = 20G, 60G, and 120G respectively.

A.2.2 Non-Neutral Plasma Device (SMARTEX-C)

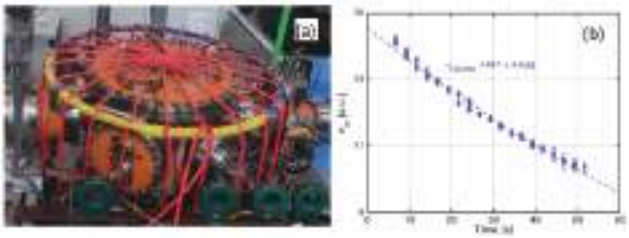


Figure A.2.3: (Left) SMall Aspect Ratio Toroidal Electron plasma eXperiment in 'C' shaped geometry (SMARTEX-C) device. (Right) Electron plasma life-time (density e-folding - 1/2.7) exceeding 100 seconds.

<u>*Confinement Time (life-time) of Toroidal Electron Plasma Exceeding 100 Sec Achieved:*</u> Pure electron plasmas are of great interest for two reasons. Firstly, they can serve as test beds for many open issues in fundamental physics like compressible fluid-dynamics. Secondly, Ion Traps, which can be prepared using similar techniques, are a potential candidate for developing ion trap-based quantum computing. Over the past few decades, institute has made major contributions in the field of pure electron plasmas confined inside a magnetic "cage" in a toroidal geometry. Recently, the SMARTEX-C experiment in the instute has achieved the highest confinement time of pure electron plasma ever reported in the world, viz., exceeding 100 seconds (Figure A.2.3) which is more than an order of magnitude higher than that reported in other countries.

<u>*Evaporative Dump Diagnostics for Electron Temperature:*</u> Estimation of electron temperature is carried out by measuring the number of trapped electrons energetic enough to escape past the confinement potentials of SMARTEX-C. This is commonly called evaporative dump technique. The charge collector (collector grid + collector shield) voltage is ramped slowly to ground in microsec time scale and the current is measured due to charges falling on the charge collector. Number of charges that escape are obtained as a function of the potential barrier, by integrating the current signal. If the distribution is assumed Maxwellian, then on a semi-log scale the charge versus voltage is linear and its slope provides an estimate of parallel temperature of the electron cloud. Increase in the injection of total stored charge by nearly 10% has been obtained by controlled switching-off of the filament.

<u>*Charge Collector Diagnostics Upgrade:*</u> Signal to Nosie Ratio (SNR) of the charge collector diagnostics for long hold time (i.e. exceeding one second) has been improved by an order of magnitude with the control of collector pulse rise time. The improved SNR has enabled measurements related to total stored charge for hold time of 10 second. A new alternate diagnostics to measure total stored

charge based on capacitor charging has been developed and results have been corroborated with the improved charge collector diagnostics.

A.2.3 Basic Experimental Toroidal Assembly (BETA)

External-q Experiments in Current-less ECR Plasma of Basic Experiments in Toroidal Assembly (BETA): In BETA (aspect ratio R_0/a = 45cm/15cm), the plasma discharge current is about 5 Amperes. As a result the magnetic field produced by plasma current is negligible and is often referred to as "current-less" toroidal plasma device. The confinement of particles and energy is only due to external magnetic fields - toroidal and vertical fields.

There are presently two plasma sources (a) hot cathode (tungsten filament) and (b) electron cyclotron resonance (ECR) sources. Presence of toroidal geometry, radial gradients in plasma density, electron temperature and toroidal magnetic field (B_ϕ) naturally provide free energy sources for the instabilities and transport. To generate the external poloidal magnetic field (B_θ), a toroidal conductor and its support structure has been designed. For these experiments, a 1kW/2.45GHz magnetron source based ECR system has been developed. In addition to this, a Reynolds-stress probe has been installed for the measurements of fluctuations induced flows during plasma experiments. Following works have been carried out:

i) Measurements of temporal profile of Reynolds stress and radial profile of mean poloidal flow of BETA plasma carried out with filament discharges at ~2A discharge current.
ii) Fabrication and testing of electron temperature circuit has been completed. Preliminary experiments were performed to measure electron temperature with filament discharges.

A.2.4 System for Microwave Plasma Experiment (SYMPLE) Device

System for Microwave Plasma Experiments: For controlling ν_{eff}, microwave Step Transition Structures (STS) have been designed using Mician software and one such structure is fabricated. Test experiments have been carried out by launching microwave inside the vacuum chamber measuring the electric field profile and cross checking the same with desired TM (TM_{03}) output. The experimental results establish that both ν_{eff} (relative permittivity) and L_n (microwave wavelength) can be varied as independent parameters, for studying microwave reflection experiments, which is a prime requirement for microwave plasma interaction study. Another development has been installation of a shielded enclosure in the laboratory, and carrying out various test experiments to validate the shielding efficiency. A time synchronization circuit is designed and developed to synchronize plasma and microwave shots.

A.2.5 Helicon Plasma System (HeliPS) Laboratory

Study on the Influence of External Magnetic Field on Nitrogen RF Discharge: The Helicon plasma source set-up shown in figure A.2.4 consists of a source chamber of glass coupled to a stainless steel expansion chamber. A half helical antenna of 18 cm length is wrapped around the glass chamber and a 3 kW, 13.56 MHz radio frequency (RF) source through a matching network connected to the antenna provides RF power to the system. In order to confine the plasma radially, at the source chamber, six electromagnets are used which establishes a uniform dc magnetic field along the axis of the source chamber. In this experiment, a maximum magnetic field of 300 G has been applied by passing a dc current up to 60 A. An RF compensat-

ed Langmuir probe is used to measure the plasma density as well as the electron temperature. Optical emission spectroscopy is enabled through a two channel spectrometer system. Data collected from LP shows all three mode transitions (E, H, and W mode) in presence of magnetic fields whereas for no magnetic field only two modes (E and H) are visible.

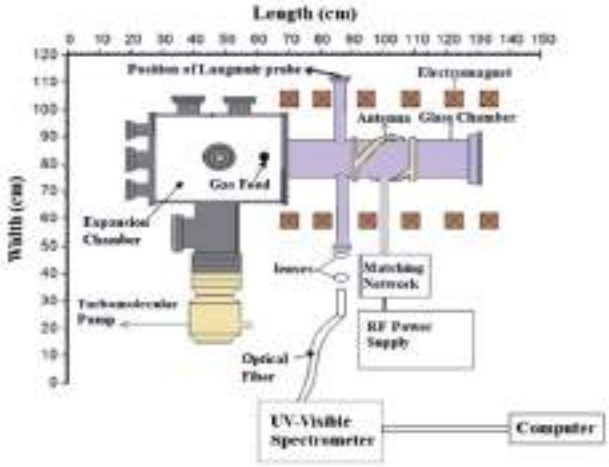


Figure A.2.4: Helicon Plasma Source experimental setup.

An important inference from this study is that in the absence of a magnetic field, the dissociation of nitrogen molecules or the production of atomic nitrogen attains a relatively large value which can further be utilized in different plasma chemical processes where the higher concentration of atomic nitrogen plays an important role. The observations may be useful in applications in various fields such as semiconductor etching, surface modifications, nitride film deposition, self-breathing thrusters etc.

A.2.6 Double Plasma Device Laboratory

Effect of Cage Bias and Electron Emission on the Two-Electron Temperature Groups in a Hot Cathode Discharge: The experiment is carried out in the stainless steel cylindrical shaped chamber (Figure A.2.5). The region where plasma is produced is called the source region and the region to which plasma diffuses is called the target region. Two identical multi-pole magnetic cages are present in the source and target regions. The cages are made up of fourteen vacuum sealed rectangular channels filled up with cube shaped strontium ferrite magnets of 0.12 Tesla. Between the two cages, the magnetic filter is placed which consists of two separate stainless steel channels. Five tungsten filaments are also placed in the target cage to assist in the increase in the density of plasma in the target region. This helped to further increase the density of low energy electrons to 10^{17} m^{-3}. The cage biasing technique coupled with additional electron emission has resulted in increasing the density from 10^{13} m^{-3} to 10^{16} m^{-3} thereby creating more favorable conditions for negative ion formation.

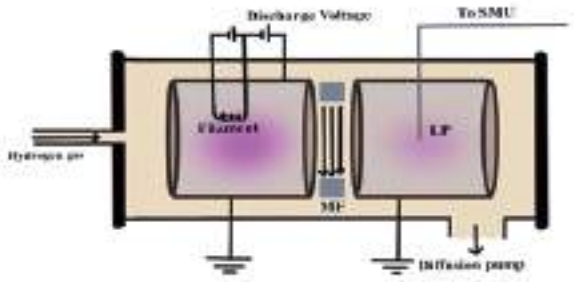


Figure A.2.5: A schematic of the Double Plasma Device (DPD) with two magnetic cages inside a cylindrical chamber. The cage where the filament is shown is the source cage, and the cage with the Langmuir Probe (LP) is the target cage. Magnetic Filter (MF) separates the two cages into two different regions.

A.3 Tokamak Experiments

Standard discharges of plasma current of ~ 120 kA, duration 300 ms at toroidal magnetic field of ~1.28 T were achieved in ADITYA-U. Several new diagnostics systems were also commissioned in ADITYA-U including the soft x-ray crystal spectrometer, neutral particle analyzer etc. In SST-1, a new 80K phase separator was setup for cry absrober. The foloowing section describes the major developments.

A.3.1 ADITYA-Upgrade Tokamak

ADITYA Upgrade Operations: Aditya-U underwent a major vessel opening operation. This allowed the installation of a Passive Active Multijunction (PAM) antenna at radial port no. 5 for the Lower Hybrid Current Drive (LHCD) system. Additionally, three modules of divertor tiles made up of graphite material have been installed at symmetric toroidal locations inside the Aditya-U vacuum vessel, at radial port No. 5, radial port No. 11 and radial port No. 20 respectively. The installation consists of a total of 44 graphite tiles and 88 specially engineered graphite caps, which have been placed collectively inside the vacuum chamber (Figure A.3.1).

Figure A.3.1: In-vessel view of graphite divertor tiles in Aditya-U at (a) Radial Port No. 5, (b) Port No. 11 and (c) port No. 20.

The Aditya-U vessel and LHCD system's seal joint underwent a successful leak test at a background level of 10^{-9} mbar l/s. After installation of these subsystems, the vacuum vessel, including the LHCD wave launcher assembly, was baked up to 1200 ^{0}C for 48-hours, and no leaks were found in the entire LHCD assembly following this operation. Base vacuum of ~ 1 x 10^{-8} torr has been achieved. Installation of new graphite-based diverter tiles resulted in an increased surface area of the carbon component, posing a new challenge in achieving standard Aditya-U plasma discharges (Figure A.3.2). However, after appropriate adjustment of operational parameters, standard discharges of plasma current (I_p) around 120 kA, lasting 100-300 ms at toroidal magnetic field (B_T) between 1.07 T and 1.28 T were successfully obtained.

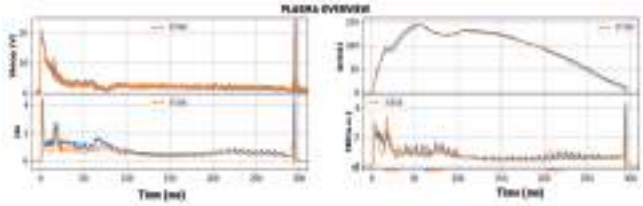


Figure A.3.2: Aditya-U discharges after graphite tiles installation.

Localized Wall Cleaning by Sweeping ECR Layer in Aditya-U: Tokamak Wall Conditioning (WC) is indispensable for controlling fueling, wall recy-

cling, quality and reproducibility of plasma discharges. In presence of toroidal magnetic field, the glow discharge cleaning cannot be carried out. Alternate cleaning methods based on ICR and ECR plasma need to be developed. However, as the homogeneity is an important factor in WC, the Electron Cyclotron (EC) and Ion Cyclotron (IC) produced plasmas are localized at resonance and antenna locations respectively. Hence, experiments are required to establish effective cleaning with these RF techniques.

Figure A.3.3: Visible camera images showing EC resonance. The resonance position oscillates between HFS toroidal limiter (a) and LFS limiter (b) Line integrated visible emission is shown in (c).

In Aditya-U tokamak, such an experiment is conducted with a specific objective of globalized cleaning by sweeping the EC resonant plasma produced with help of a 2.45 GHz magnetron source. The resonance location is swept from LFS to HFS (Figure A.3.3) by varying the Toroidal magnetic Field (TF) with the help of a programmable DC power supply. A density of ~1 x 10^{16} m^{-3} is produced with less than 2 kW of RF power at fill hydrogen pressure of 5 x 10^{-5} torr. The TF coil current is adjusted based on the resonance location detected from the visible camera and radial location determined from multi-fiber system. Various gas species (CO, C_2H_4, CO_2, H_2O) desorbed from the wall, are observed to contribute to more than one order of magnitude of their respective partial pressure.

Apart from the above, several experiments namely, plasma disruption prediction activities on Aditya/ Aditya-U, effect of impurity seeding on toroidal rotation in Aditya-U, edge toroidal rotation in Hydrogen/ Deuterium plasmas with impurity seeding, REs studies in Aditya-U using Neon seeded plasmas (Figure A.3.4), ICRF plasma production for pre-ionization have also been carried out in Aditya-U tokamak during the reported period. Figure A.3.5 shows the sustenance of IC plasma which is initiated by an EC plasma. This will very useful in pre-discharge cleaning of the machine.

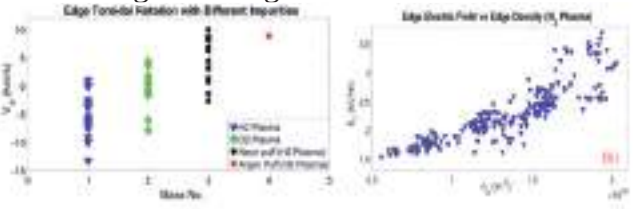


Figure A.3.4: Edge toroidal rotation measured by Doppler shift spectroscopy and high edge electric field measured using Langmuir probes.

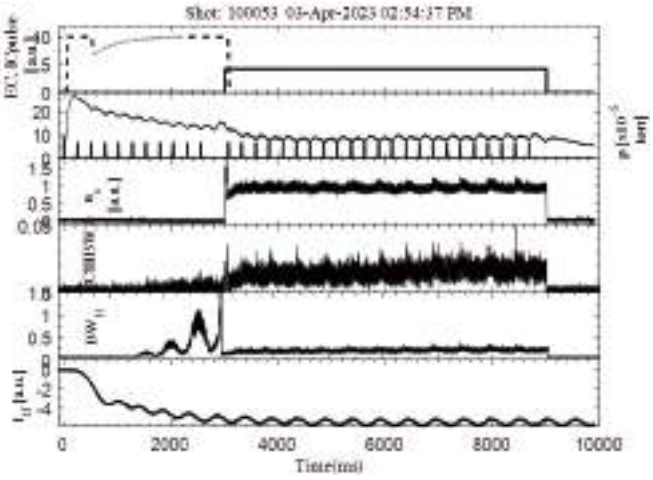


Figure A.3.5: EC assisted ICR discharges.

<u>*Runaway Electron Mitigation using Local Vertical Field Perturbation in Aditya-U:*</u> The mitigation of runaway electrons (REs) is a critical area of research in the field of fusion worldwide and is currently at the forefront of Aditya-U's research agenda. A novel technique for effective mitigation by application of local vertical magnetic field (LVF) perturbation is developed in Aditya-U. The

LVF perturbation is applied using a pair of electromagnetic coils placed at the top and bottom of Aditya-U vacuum vessel in a Helmholtz configuration at one toroidal location. The coils are powered by a capacitor bank power supply and are capable of producing perturbation fields of the order of ~ 150 – 300 G at the plasma center for a short duration (5 -20 ms). With the application of LVF pulse the REs are significantly reduced as indicated by the reduction in the REs generated hard X-ray flux, shown in figure A.3.6. REs mitigation using LVF perturbations may be envisaged as an additional tool in bigger tokamaks even though the extrapolation of this technique for large-size machines including ITER needs more experimentation.

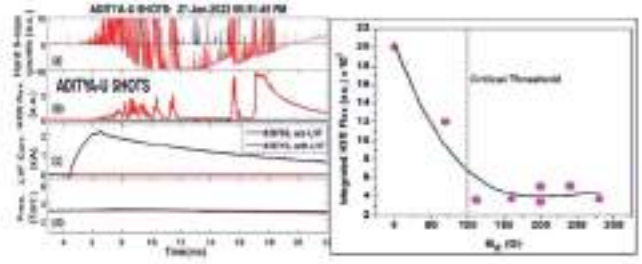


Figure A.3.6: Time traces of (a) hard X-rays (a.u.) (b) hard X-rays flux (a.u.) (c) LVF perturbation (Gauss) and (d) Pre-filled pressure (torr) for with (#36710) and without (#36708) LVF discharges and Time-integrated HXRs flux signal (0-15 ms) as a function of peak applied LVF perturbation amplitude.

Role of Pinch in Argon Impurity Transport in Ohmic Discharges of Aditya-U Tokamak: Argon line emissions in visible and Vacuum Ultra Violet (VUV) spectral ranges arising from the plasma edge and core respectively are measured simultaneously in the Argon gas puff experiments. During the experiments, space resolved brightness profile of Ar^{1+} line emissions at 472.69 nm (3p44s 2P3/2–3p44p 2D3/2), 473.59 nm (3p44s 4P5/2–3p44p 4P3/2), 476.49 nm (3p44s 2P1/2–3p44p 2P3/2) and 480.60 nm (3p44s 4P5/2–3p44p 4P5/2) are recorded using a high resolution visible spectrometer. Also, a VUV spectrometer has been used to simultaneously observe Ar^{13+} line emission at 18.79 nm (2s22p 2P3/2–2s2p2 2P3/2) and Ar^{14+} line emission at 22.11 nm (2s2 1S0–2s2p 1P1). The diffusivity and convective velocity of Ar are obtained by comparing the measured radial emissivity profile of Ar^{1+} emission and the line intensity ratio of Ar^{13+} and Ar^{14+} ions, with those simulated using the impurity transport code, STRAHL. Argon diffusivities of ~ 12 m^2/s and ~ 0.3 m^2/s have been observed in the edge ($\rho > 0.85$) and core region of the Aditya-U, respectively. The diffusivity values both in the edge and core region are found to be higher than the neo-classical values suggesting that the argon impurity transport is mainly anomalous in the Aditya-U tokamak. Also, an inward pinch of ~ 10 m/s mainly driven by Ware pinch is required to match the measured and simulated data. The measured peaked profile of Ar density suggests impurity accumulation in these discharges.

Investigation of Temporal Evolution of Hard X-Ray Spectrum from Neon-Seeded Plasma of Aditya-U Tokamak: The adverse effect associated with runaway electrons (RE) requires the temporal monitoring of the Hard X-ray (HX) spectrum produced by RE. This enables the measurement of the photon flux corresponding to a particular energy of HX in temporal space. A Lanthanum Bromide ($LaBr_3$)-based HX spectrometer system (80 keV - 5 MeV) is routinely operated on the Aditya-U tokamak for monitoring the temporal evolution of the HX spectrum. The temporal evolutions of the HX energy having maximum count and the average RE temperature (RE average energy) have been analyzed for the plasmas injected with neon (Ne) impurity. It has been found that peak energy and average runaway energy reduces significantly after the Ne gas puff and this reduction happens when the electron density rises after the Ne gas puff. The RE tem-

perature values were ~ 620 KeV and 230 KeV before and after the Ne injection (Figure A.3.7), respectively. The spectral shape, in both counts and energy, shrunk drastically, suggesting the reduction of the HX emission after the Ne gas puffing

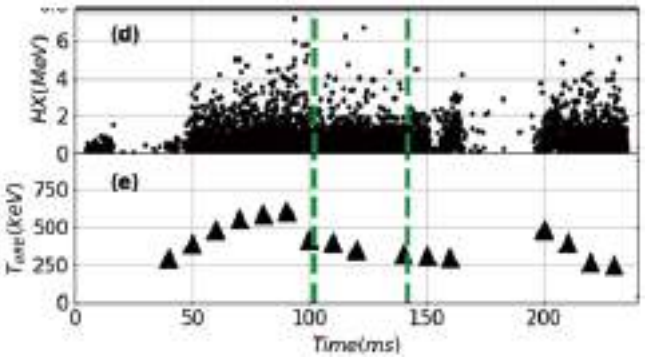


Figure A.3.7: Hard x-ray energy measured with $LaBr_3$-based Hard X-ray spectrometer.

A.3.2 Steadystate Superconducting Tokamak -1 (SST - 1)

In SST-1, an LN_2 phase separator was developed and the refurbishment task on the vent return line of SST-1 80 K distribution system (Figure A.3.8) has been carried out.

Figure A.3.8: 80 K Phase separator and Test set-up for cryo adsorber.

This is done to prevent the loss of LN_2 from the 80 K return vent line. For this purpose, a vacuum-jacketed Cryo transfer flexible line with PTCFE seal NRV was installed and tested successfully. Its performance test was carried out at 300 K and 77 K and the helium leak tightness was found to be $7.5x10^{-9}$ mbar-l/s. The analog controller of TF coil Power Supply (TFPS) was replaced with new DSP recon controller. This was prompted by some faults observed during the last SST-1 experimental campaign (Figure A.3.9).

Figure A.3.9: DPS recon controller.

All interfaces were reconnected and gate pulse to SCR was rewired. Protections (Quench, bypass trigger and main pulse block) were rechecked. TFPS was operated at 4.8 kA in steady state and was tested many times to see the performance under the replaced DSP controller. Readiness of DSP recon software (Figure A.3.10), its connector and configuration for increase of voltage and current output is being ensured to attend to any emergency during campaign.

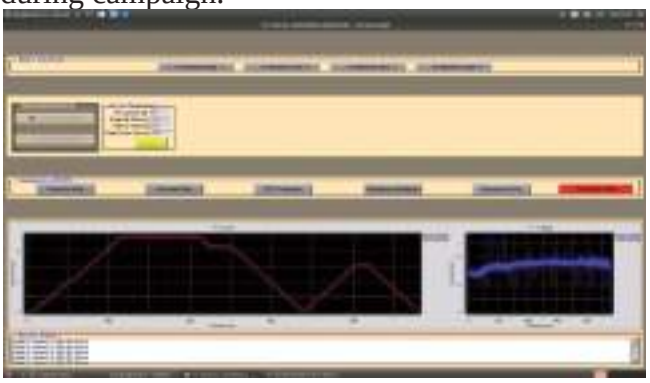


Figure A.3.10: DSP based TF PS controller card; the steady state operation in short link.

Hardware In Loop Testing activities have been carried out for developing Plasma Control modules. A Linear Plasma Model is being developed. Pres-

ently, a 30 years old power supply is used for powering the VF coil used for plasma equilibrium and confinement. The current waveform of VF power supply is manually set prior to the experiment. A MATLAB Simulink model of Vertical field (VF) power supply has been developed for providing support to the plasma operator so that during the experiment, VF current waveform can be generated based on the required plasma current. In this regard, Plasma Current Conditioning (PCC), a Reverse VF Power Supply simulation model has been developed to cater to the experimental requirements along with a MATLAB based signal profiler for generating VF current profile based on required plasma current (Figure A.3.11).

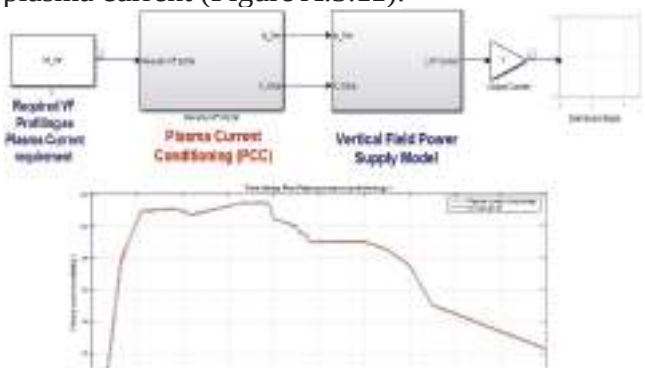


Figure A.3.11: Current waveform of the vertical field coil.

The PCC model has rigorously been tested and validated against various experimental data (with acceptable error tolerance). It is being implemented with the actual hardware and to enable its use in the upcoming experimental campaign.

Lower Hybrid Current Drive: The regular maintenance work for high power klystron auxiliary systems was carried out. The high voltage conditioning and rf conditioning of klystrons was also carried out. In addition, the preparation for the LHCD system for SST-1 campaign #31 and Aditya-U campaign was carried out for the LH experiments.

The PAM launcher was installed in Aditya-U. It has successfully passed the baking cycle and UHV test as per the requirements of the tokamak. The photograph of PAM launcher from the inside of the machine is shown in figure A.3.12. The high power rf divider section was installed in the tokamak hall to split the single input line into two output lines (having directional couplers in each line and phase shifter in one line) which were then connected to two inputs of PAM through a pill-box type rf vacuum window (Figure A.3.13). The photograph of the LHCD system outside the tokamak machine is shown in figure A.3.12. Fiber optic cable was laid from high power source side (data acquisition and control (DAC) system located in SST-1 hall) to Aditya-U Trigger unit rack (located in Aditya hall) and electronics circuit was installed for the synchronization of the triggering pulse for LHCD system from central control system of Aditya-U. Interlock circuitry was developed to inhibit the rf power in case there is no plasma formation during experiment. The RF characterization of the entire transmission line, components and divider section was carried out. Diagnostic system was installed which included rf power detection card (to measure the forward and reflected power of two lines connected to PAM), Langmuir probe diagnostic (to measure the edge plasma density in front of PAM) and hard x-ray diagnostic system using CdTe based detector. Good coupling of PAM launcher with plasma was demonstrated both with, low (~100mW) as well as with high (~120kW) rf power and typical result is shown in figure A.3.14. Reflection co-efficient (RC) below 5% was achieved even when PAM launcher was placed ~15mm behind limiter. PAM demonstrated non-inductive current drive in hydrogen and deuterium plasma with low reflection co-efficient. Also it showed improved coupling in the presence of ECRH power. Plasma current in Aditya-U could be extended up to ~ 230ms with PAM launcher, when tokamak was operated with

positive convertor only. Typical results obtained are shown in figure A.3.15. Plasma current in Aditya-U could be extended up to ~ 430ms with PAM launcher, when tokamak was operated with negative convertor also and typical results obtained are shown in figure A.3.16.

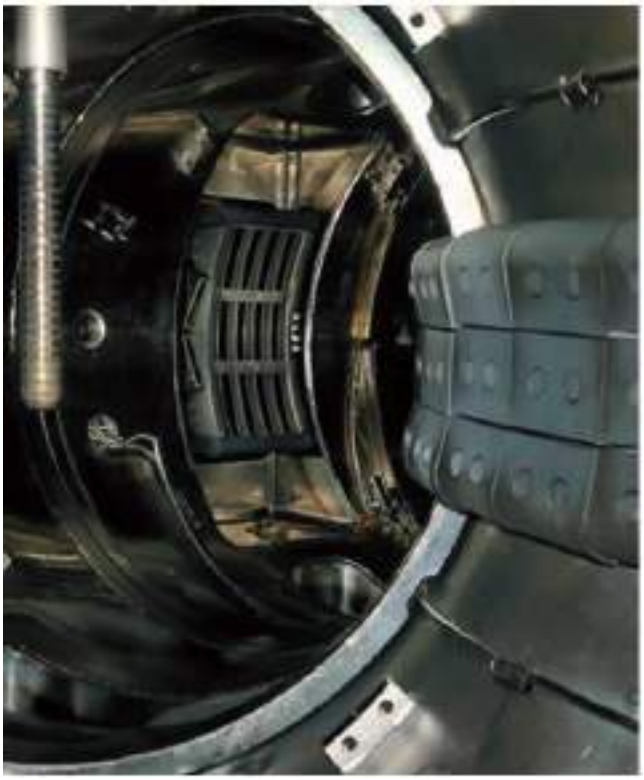


Figure A.3.12: PAM launcher inside the machine.

Site Acceptance Test of 11kV, 2 MVA voltage variation system (VVS) was successfully carried out. The major tasks included interconnection of internal three units as per layout, repairing of control unit of VVS, insulation test, oil break down voltage (BDV) test, low voltage charging of VVS, cable termination, filtration of oil in all the three units, open circuit testing and charging the 2MVA system with 11kV. After successful completion of wire burn test, the power supply was subjected to load test with klystron connected to it. A simulation work was also carried out for analyzing the current and output voltage behavior during fault condition for the testing power supply having rating -70kV, 22A connected with VVS.

The rectangular to circular converters, developed for the testing of reactor relevant oversized corrugated circular waveguide bend, were tested, in back to back configuration, for high power rf performance up to ~90kW for ~500ms. The developed high power circulator at 3.7GHz was tested for high power rf performance up to ~25kW for ~100ms. WR340 based DC-breaks were developed for the ECR system of small scale spherical tokamak (SSST) and was successfully tested for high power rf performance up to 6kW–5sec. The high voltage power supply of 2.45GHz, 6kW magnetron was repaired and tested on resistive load for 5 seconds at 7kV. Subsequently, it was connected with magnetron head and successfully tested for high power rf of 5kW for 4s. The designing of 7.5kV, 1.5A high voltage power supply for magnetron is in progress. A new DPR for LHCD HVDC Power Supply (-70kV, 40A) is prepared and submitted to the department for approval.

Figure A.3.13: High power divider section with two output lines connected to PAM outside the machine.

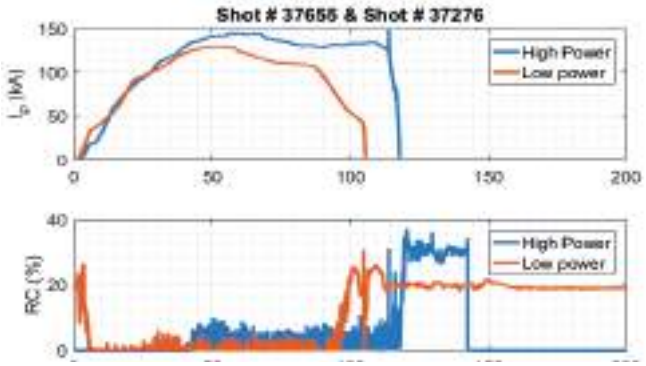


Figure A.3.14: RC measurements using low and high rf power is shown in the presence and absence of plasma.

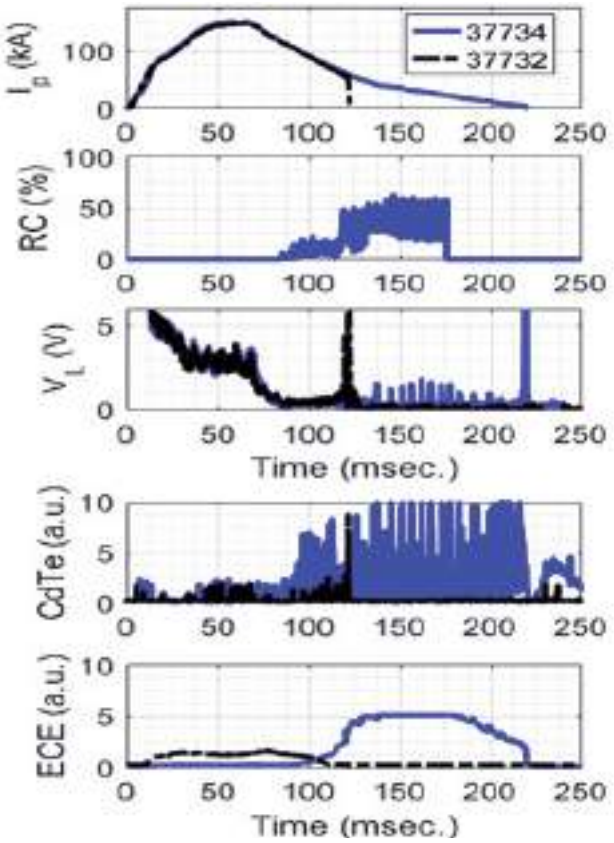


Figure A.3.15: Results of two plasma shot (with and without LH power) is compared to show the elongation of plasma current up to ~230ms with LH power, when machine is operated with positive convertor.

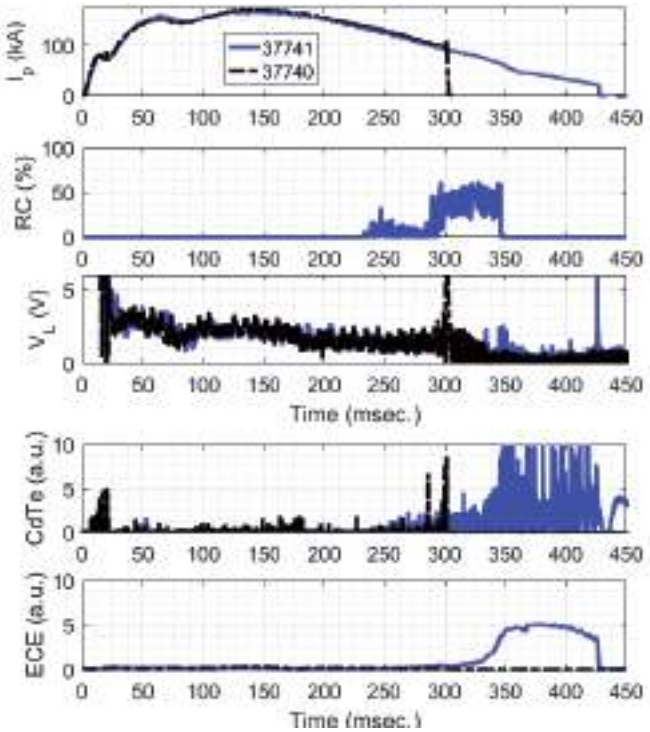


Figure A.3.16: Results of two plasma shot (with and without LH power) is compared to show the elongation of plasma current up to ~430ms with LH power, when machine is operated with negative convertor also.

A.3.3 Tokamak Diagnostics

Observation of Tearing Modes using Fast Visible Imaging Diagnostic: The fast visible imaging diagnostic (FVID) system consisting of a high speed camera, fiber optic bundle, and lenses (Figure A.3.17) is operated regularly in Aditya-U. A Phantom v7.1 fast framing camera equipped with a complementary metal-oxide-semiconductor (CMOS) detector that can capture 150k frames per second (fps) at a resolution of 16 x 8 pixels is used for plasma imaging. It provides the tangential view of the poloidal cross-section of the plasma column to monitor the two-dimensional plasma profiles. The spatial resolution of the system at the tangency plane is 2.9 mm.

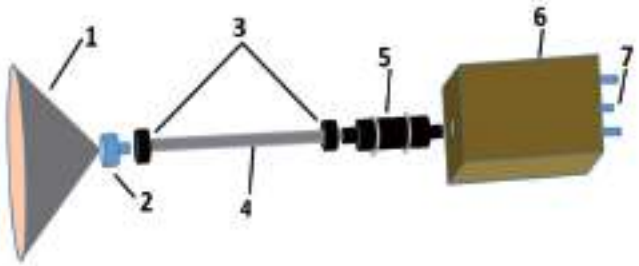


Figure A.3.17: Schematic of Fast Visible Imaging Diagnostic; 1- field of view (FoV). 2- objective lens, 3- c-mount adapter connected with fiber optic bundle, 4- fiber optic bundle, 5- relay lens (1:1), 6- fast framing camera, and 7- connection to control server/DAQ.

Taking advantage of camera's fast frame rate, a straightforward Fourier analysis of individual pixel's time series allows us to study the temporal evolution, mode phase and amplitude of the oscillating modes. Therefore, a set of image processing techniques and tools have been developed to identify and study the temporal evolution of oscillating modes. Using such techniques on plasma images, the rotating~11 kHz tearing modes have been identified and studied in many plasma discharges of Aditya-U tokamak.

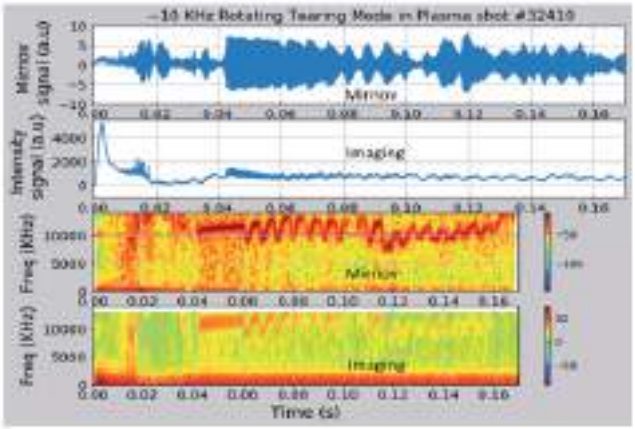


Figure A.3.18: Observation of rotating~11 kHz TMs in Mirnov coil signal and imaging signal in plasma discharge #32410.

The same rotating~11 kHz tearing modes have also been observed in Mirnov pick up coil's signal (Figure A.3.18), and thus, the observation of TMs in visible plasma images has been benchmarked with the Mirnov signal (Figure A.3.19). The study established the capability of high speed camera and image processing techniques in terms of detecting the oscillating modes at higher frequencies in tokamak plasma.

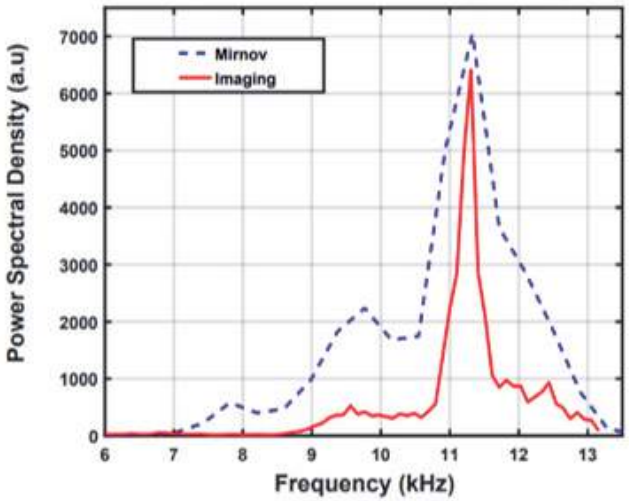


Figure A.3.19: The power spectral density.

Sensitivity improvement in Magneto-Optic Current Sensor (MOCS) by Introduction of Twist in the Optical Fiber: Recently, there are new advancements made to improve the sensitivity and the performance of the MOCS diagnostics namely the introduction of twists in the single mode optical fiber (SMF) to suppress its linear birefringence leading to a better sensitivity. SMF passing through a conduit with an optimal diameter to suppress mechanical vibrations induced noise and a few turns of the SMF around the vacuum vessel shows significant enhancement in the sensitivity by threefold as well as effective suppression of the background field contamination arising from toroidal and vertical fields during the tokamak operation. Plasma current measurements conducted on the Aditya-U tokamak using this efficient MOCS diagnostic system demonstrated an exceptional sensitivity of

≤0.5 kA and a temporal resolution of ≤100 μs. The plasma current measurements using the MOCS are in agreement with the conventional Rogowski coil measurements (Figure A.3.20).

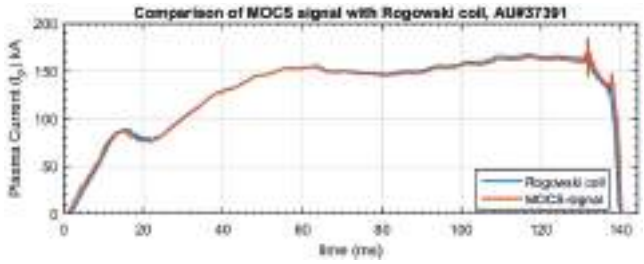


Figure A.3.20: Plasma current measurements using MOCS diagnostic setup installed on the Aditya-Upgrade tokamak and comparison of its measurements with Rogowski-coil.

<u>*Development activities in Michelson Interferometer Diagnostics:*</u> A high temperature black body calibration source at 600 °C has been successfully designed, developed and characterized for the Michelson interferometer diagnostics with improved emissivity in the 2nd harmonic ECE frequency range (Figure A.3.21). Also, development of closed loop dry cryogenic detection system for up-gradation of the diagnostic for cryo-free operation is in process. The empty cooler cool down test has been performed successfully (Figure A.3.22).

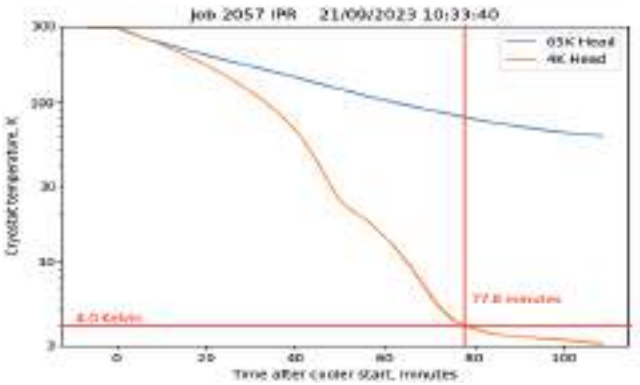


Figure A.3.22: Empty cooler cool down test.

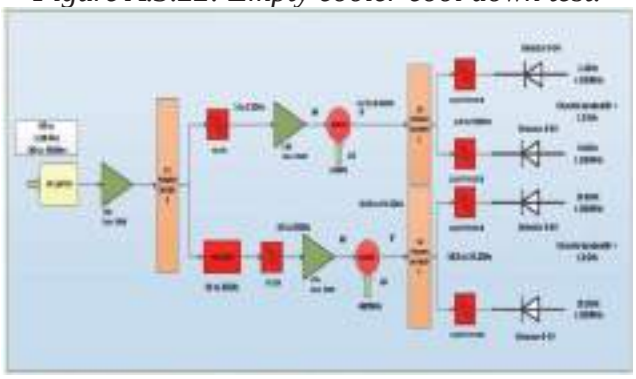


Figure A.3.23. Block diagram of the 16-channel IF receiver.

<u>*Design and Characterization of 16-channel Intermediate Frequency (IF) Receiver:*</u> A 1-20 GHz, 16-channel Intermediate Frequency (IF) receiver was designed (Figure A.3.23) and characterized (Figure A.3.24) in the laboratory. This system shall stand as a back end to any radiometer receiver sys-

Figure A.3.21: (a) Black body calibration source, (b) Closed loop dry cryogenic detection system.

tem to enhance its measurement dynamic range and provide electron cyclotron measurements at 16 radial locations in the plasma. The characterization of the system includes measurement of various parameters of the integrated components like the filter pass-bands, amplifier gain and noise figures and power divider losses. Table-1 shows the specifications of the system while figure A.3.25 depict the measurement results.

Table-1: Technical Specifications of the 16-channel IF receiver.

Sr.No.	Parameter	Specification
1	Input Frequency (GHz):	1-20
2	Output Video bandwidth	DC -1 MHz
3	Number of channels:	16
4	Noise Figure:	6 dB or better
5	Overall Gain:	40-50 dB
6	Mixer usage:	Single sideband
7	Bandwidth per ch.	±200MHz
8	Max output voltage:	0-5V

Figure A.3.24: Characterisation procedure carried out to check the spurious level at IF output end and the cross-talk between the channels.

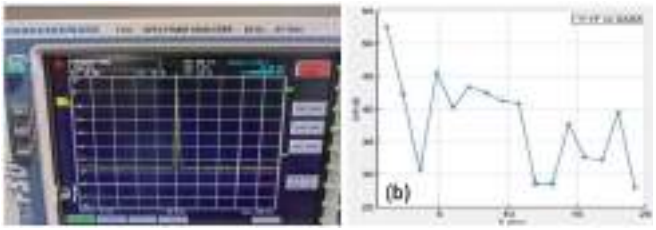


Figure A.3.25: (a) shows the LO/source frequency with single peak @ 12 GHz and (b) the measured total system gain.

Design and Characterization of W-Band Trans-receiver Sub-system: A 90 GHz millimetre wave (MMW) radar concept based Trans-receiver circuit is being developed to calculate the relative displacement/vibrations of an object at a distance greater than 15m as shown in figure A.3.26. Usage of a high operating frequency and a super heterodyne detection scheme adds to the higher sensitivity of detection for small target vibrations/displacements about the mean position. Designed with a Quadrature (I/Q) technique, the system is expected to have a low noise figure of less than 8-10 dB, dynamic range of 40dB while the overall gain of the system shall lie around 30 - 40dB.

Table-2 Technical Specifications of the W-band Trans-receiver.

Sr.No.	Parameter	Specification
1	Transmitter Frequency (GHz)	90
2	Transmitter Power (dBm)	+15
3	Receiver Frequency (GHz)	90 + □
	□ (Any fixed frequency within, MHz)	100 to 600
4	Antenna gain (dB)	23
5	Low noise amplifier gain (dB)	□ 20
6	Low noise amplifier Noise figure (dB)	6 or better
7	Output signal (I/Q)	1 Vpp @ 50ohm

Table 2 depicts the technical parameters of the designed system followed by block diagram of the

receiver system and few characterization results shown in figure A.3.27 and A.3.28.

Figure A.3.26: Receiver characterization setup.

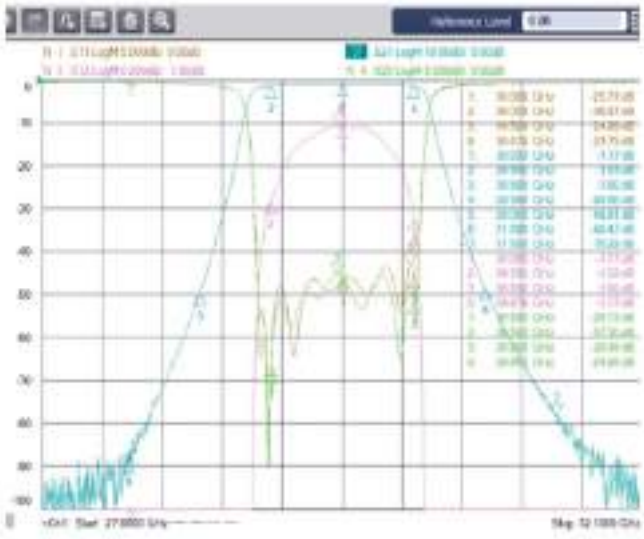


Figure A.3.27: Band pass filter response.

<u>*Design and Simulation Results of MACOR View dump Prototype for new Vertical Electron Cyclotron Emission (V-ECE) Diagnostic:*</u> The received cyclotron radiation at $\Theta = 90°$, gets corrupted due to infiltrations from wall scattering and reflection in the antenna field of view. To avoid such infiltrations, a view dump is placed at the bottom of the vessel chamber, where the antenna view falls. MACOR having excellent machining capabilities and the ability to withstand high temperature along with good microwave absorption capabilities due to the designed structure provides a standard dump material. The view dump is designed using CST microwave studio. The design structural parameters like pyramid height, thickness and other properties of the dump were varied to see their effect on its absorption / reflection properties in the desired frequency range as shown in figure A.3.29 (a & b). Figure A.3.29c depicts the reflectivity properties of the designed structure in 60 – 110 GHz frequency range

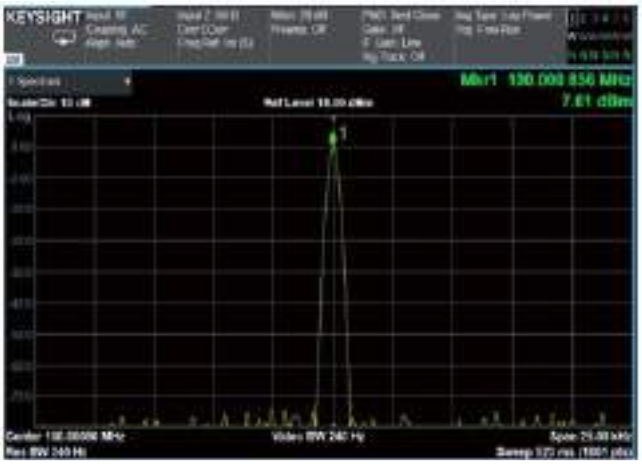


Figure A.3.28: 100 MHz crystal oscillator response.

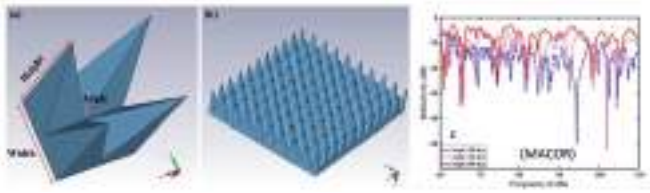


Figure A.3.29: Modelled pyramidal geometry (a) unit cell and (b) its periodic nature (c) Simulated reflectivity for MACOR.

<u>*Neutral Particle Analyzer Based Charge Exchange Diagnostics [CX-NPA] at Aditya-U & SST-1:*</u> A 5-channel Neutral Particle Analyzer has been integrated and is working for core Ion temperature

measurements of Aditya-U plasma (Figure A.3.30). This diagnostics can measure the Ion temperature of the Aditya-U plasma from 120 eV to 3 keV with a time resolution of 10 ms of plasma evolution. Recently the DAQ has been upgraded for the remote operations during plasma shots.

Figure A.3.30: CX-NPA System at Aditya-U.

Soft X-ray Diagnostic with Provision for Various Filter Thickness Combinations: A Soft X-ray (SXR) diagnostic is being developed to study the energy range of SXRs emitted from the Aditya-U tokamak plasma. The diagnostic employs the absorber-foil technique for the measurement. The intensity of SXR radiation will be captured and measured using a pair of Surface Barrier Diode (SBD) Detectors. The diagnostic has provision for the selection of Beryllium filters of different thicknesses to allow the measurement of SXR radiation falling in different energy ranges. Three pairs of Beryllium foils are mounted on a rotatable arrangement, which can be adjusted externally without breaking system vacuum.

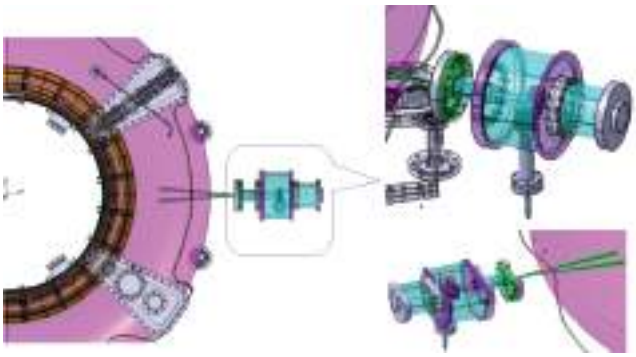


Figure A.3.31: 3D CAD drawing of Soft X-ray diagnostic with rotatable multi-filter assembly.

Figure A.3.32: Support structure assembly and electronics for SXR adjustable filter diagnostic.

The ability to switch between different filter thicknesses externally provides flexibility to enable the measurement of SXR radiation across various energy ranges and provide valuable information to the study of Aditya-U tokamak plasma. Figure A.3.31 illustrates the design of the new SXR diagnostics, while figure A.3.32 shows the diagnostic support structure assembly. The alignment of pinhole, filters assembly and detectors has been checked using visible light and the entire assembly is vacuum tested for UHV compatibility.

On-site Determination of Effective Turn-area of Magnetic Probes for Aditya-U tokamak: For the measurement of poloidal field of plasma, an array of 16 magnetic probes was installed in Aditya-U (Figure A.3.33). The magnetic probes are placed in the direction of the field to be measured. During the installation of a probe, little misalignment with the direction of field may be possible. Therefore turn-area of the probe available for the field to pass through it may get changed. Hence, the effective turn-area of the each probe was determined after their installation by a process of on-site calibration. For this, a copper current loop is placed that represents a core of plasma current. The magnetic probes respond to the loop current, and measure flux produced by that loop current. The magnetic field at the location of the probe is numerically calculated. Figure A.3.34a shows the time–trace of loop current, response of a probe, flux measured by

that probe and calculated magnetic field. The effective area of the probe is obtained from the ratio of measured flux to calculated magnetic field. Effective turn area for 16 probes shows the variation of effective turn-area of probes with one to another (Figure A.3.34b).

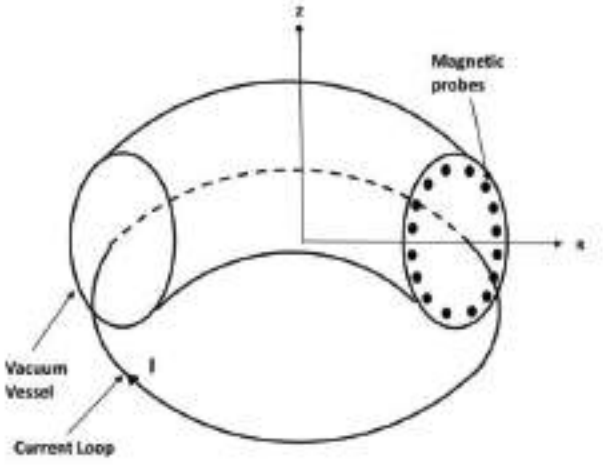


Figure A.3.33: Schematic of the current loop placed inside vacuum vessel and magnetic probes installed at a poloidal plane.

Development of Fast Response Bipolar Power Supply (FRBPS) for Aditya-U and SST-1: FRBPS (Fast Response Bipolar Power Supply) (Figure A.3.35) is an endeavor for an in-house development of TOKAMAK grade modular power supplies for Aditya-U and SST-1 TOKAMAK. Rating of FRBPS is +/-5kA, 500 VDC with ramp rate of 1 MA/s for plasma position control of Aditya-U tokamak and it is at commissioning stage. There are 06 IGBT inverter modules in parallel with N+1 redundancy. 03 numbers of IGBT inverters modules have been tested in parallel for 3 kA output (Figure A.3.36a and A.3.36b). The salient features of the system are excellent noise immunity (FO gate pulse firing circuits) in high EMC/EMI environment of Tokamak, response time of < 100 μs with 1 MA/s ramp rate for fast response and tracking of current reference; low ripple output and adaptability to existing tokamak communication interface. Real time current reference with any shape (trapezoidal, triangular, sinusoidal or random) can be given to FRBPS.

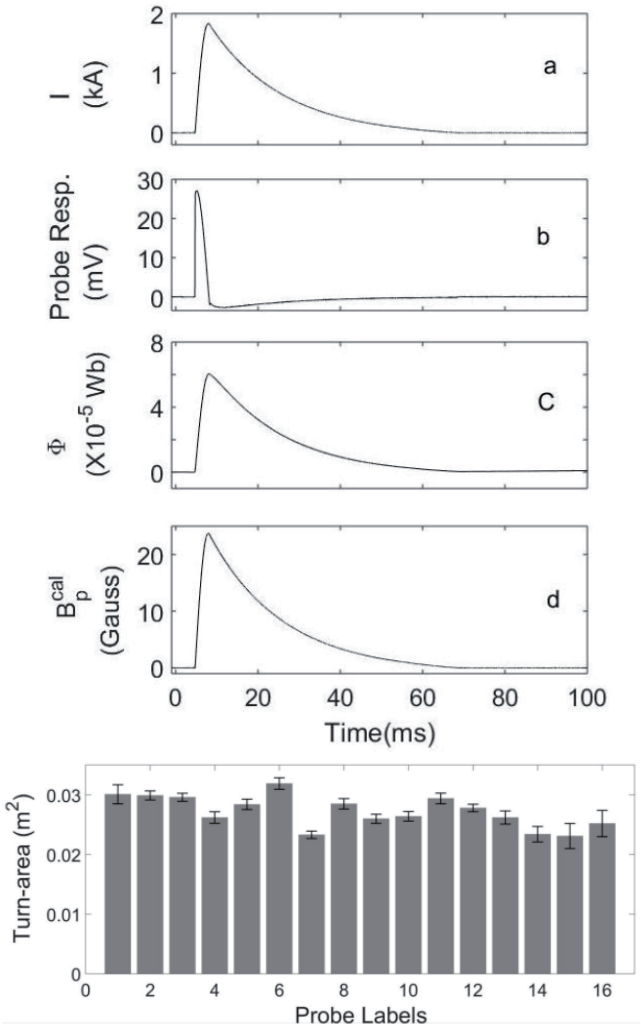


Figure A.3.34: Time evolution of (a) Loop current (b) the output of a probe, (c) flux linked with probe and (d) calculated poloidal magnetic field at the location of that probe and (e) Effective turn area of the 16 probes.

Design, Development and Successful Testing of Fast Response Bi-polar Power Supply of Rating 500V/±5kA: The Aditya-U tokamak at the insti-

tute has recently been reconfigured for divertor operation. This requires rapid bipolar variations in the "divertor coil", which must be driven by a specialized power supply (Figure A.3.37). For this application, institute has developed a fast response bi-polar power supply (FRBPS) of rating 500 V/±5 kA and successfully tested on a dummy load (Figure A.3.38). The power supply has been indigenously designed, developed and fabricated, including the DSP and analog controller and its protection circuit. The total cost of the supply is 75% lower than a similar type of commercially-available power supply.

Figure A.3.35: FRBPS integrated.

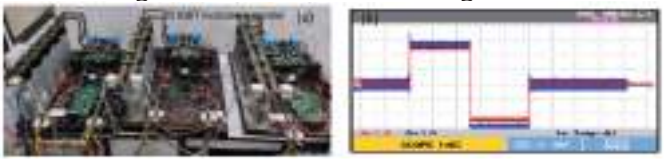


Figure A.3.36: (a) Modular design of the FRBPS and the (b) pulse captured for it bi-polar operation is shown.

The maximum ramp rate of 2 MA/s has been achieved with a hysteresis band controller. The power supply includes Fiber Optic (FO) gate pulse firing, which makes it immune to environments with high electromagnetic noise levels, such as near a tokamak. The reference output current profile can be set using the digital interface of remote control. The power supply is modular, configurable and redundant, and these features reduce the down-time of the power supply. The duty cycle of the power supply is 2 second ON and 60 second Off. If required, the operational time of the power supply can be increased as it incorporates water-cooling. Since it has been integrated in-house, the maintainability is easier as fault diagnosis and repair can be done at the institute itself. Protections have been incorporated for tokamak operation-related issues like induced voltage and plasma disruptions.

Figure A.3.37: Power Supply, inverter Panel, rectifier panel and transformer.

Figure A.3.38: Experimental set-up of the power supply with dummy load.

A.4 Fusion & Related Technologies

In continuation to the last years progress, several new technologies related to fusion science and technology have been developed. A brief about the newly developed technologies under various heads are highlighted in the following subsections.

A.4.1 Magnet Technologies

Design, Fabrication and Testing of 3.5 Tesla HTS Magnet: Compact and high field electromagnets made out of High Temperature Superconductors (HTS) are needed for a variety of applications. These include MRI machines, magnetic fusion, particle accelerators, quantum computing, superconducting magnetic energy storage, transformers, industrial motors & generators. The use of HTS tapes (currently imported) for the fabrication and testing of an HTS magnet involves challenging technologies like double pancake (DP) winding, stacking of DPs, in-situ nano-Ohm joint fabrication, fabrication and integration of current leads, and testing & protection during quench. Institute had earlier realized (a) A Bismuth Strontium Calcium Copper Oxide (BSCCO) HTS magnet with a warm bore diameter of 50 mm, capable of producing 0.2 Tesla field at 64 K, and (b) A 180 mm long HTS solenoid magnet of inner and outer diameters 110 mm & 132 mm using Rare-Earth Barium Copper Oxide (REBCO) tapes, capable of producing 1.14 T at 52 K

In a major step forward, for the first time in India, institute has fabricated a 232 mm long HTS solenoid magnet with inner & outer diameters 200 mm and 260 mm using REBCO tapes. This has produced a central magnetic field of 3.52 T at 4.2 K for over 360 sec, maintaining excellent cryostability. A photograph of the magnet, generated & measured current and field waveforms at 4.2 K are shown in figures A.4.1 (a, b and c).

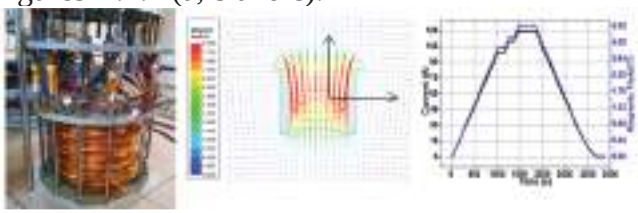


Figure A.4.1: HTS magnet, magnetic field profile and measured current & magnetic.

A.4.2 High Temperature Technologies

X-Ray Imaging in High Heat Flux Test Facility: X-Ray imaging set-up is developed to monitor the position of electron beam incident on surface of PFCs during high heat flux testing. The set-up is used to obtain cross-sectional profile of the high power, 28 kW, electron beam incident on tungsten target.

Cross-section of the beam is found to be in good agreement with the results from another experiment and its corresponding COMSOL simulation performed to measure the electron beam profile using current collected by a straight tungsten wire intercepting electron beam moving perpendicular to it (Figure A.4.2).

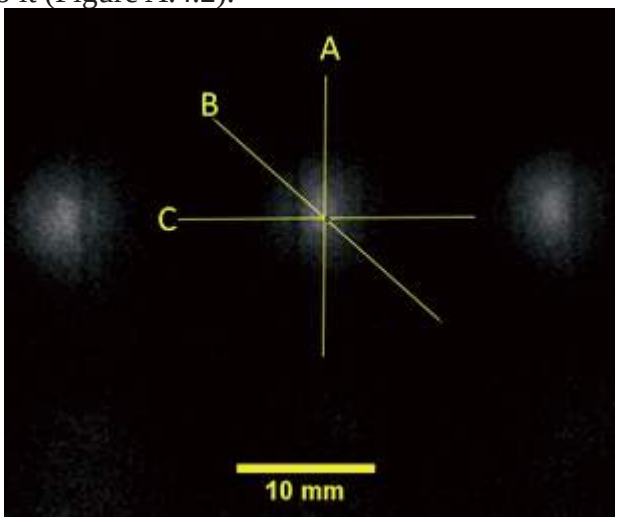


Figure A.4.2: X-Ray image of electron beam incident on tungsten target.

Tungsten Fiber Reinforced Tungsten Material Development: The Wf-W composite samples were sintered at 1700 ºC and 50 MPa pressure. For composites with & without Er_2O_3 coated mesh, the achieved parameters relate to a density ~18.0 g/cc, Grain size 15-20µm, Hardness ~400 MPa, Thermal Conductivity ~150W/mK (Figure A.4.3).

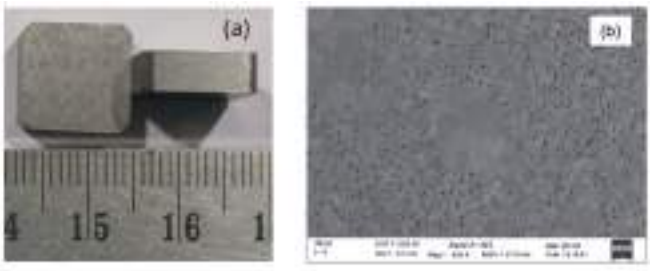


Figure A.4.3: (a) Reinforced tungsten fiber development and (b) SEM image of tungsten fiber.

High Temperature Vacuum Brazing of Tungsten to Tungsten Alloy with Structural Material: Experimental research on the vacuum brazing procedure used to join tungsten-based refractory materials and tungsten alloy with SS316L (a structural material) at high temperatures is being carried out. The objective of joining tungsten (W) to tungsten alloy material (WL10) and SS316L materials is to develop a joining technique for fabricating the helium-cooled divertor target relevant to a DEMO-like fusion reactor. These divertor fingers are expected to withstand an incident heat flux of 10 MW/m^2 and to be cooled by helium jets in an environment of high pressure (10 MPa) and high-temperature (600 °C) helium gas. High-temperature vacuum brazing has been performed at temperatures exceeding 1000 °C using selective brazing fillers in the Gleeble Machine-3800 thermo-mechanical simulator to join W (tungsten) to WL10 alloy (tungsten + 1 % Lanthanum oxide). Furthermore, vacuum brazing of multilayer materials, such as W-WL10-SS316L, has been conducted at 1050 °C for a 3 min hold time using AMS 4777 filler material in a single run on the Gleeble machine. The brazed specimens have undergone testing for 500 thermal cycles from 950 °C to 815 °C on the Gleeble-3800 machine to pre-qualify the brazed joints. Non-destructive testing (NDT), including ultrasonic testing (UT), microstructural analysis, and mechanical characterization, is employed to assess the quality of the brazed joints.

Helium Cooled Target Handling System for High Heat Flux Test Facility: Helium Cooled Target Handling System and Extension Chamber are integrated with D-Shaped vacuum chamber of High Heat Flux Test Facility (HHFTF) and tested for vacuum (Figure A.4.4). This upgrade allows testing of helium gas cooled Plasma Facing Components (PFCs) under intense heat loads. Experimental Helium Cooling Loop (EHCL) (Figure A.4.5)

will be further integrated with HHFTF to supply high temperature high pressure helium gas up to Max. Inlet Temp: 400 ºC, Max. Inlet Pressure: 80 bar and Maximum Flow Rate: 400 g/s.

Figure A.4.4: Helium cooled target handling system and extension chamber for High Heat Flux Test Facility (HHFTF).

Figure A.4.5: Helium cooled and water cooled target handling systems for HHFTF.

Figure A.4.6: Fixture for shear punch testing of tungsten using Gleeble 3800.

<u>*Shear Punch Testing of Tungsten at Elevated Temperatures using Gleeble 3800:*</u> Shear punch fixtures are developed for performing small specimen testing of tungsten at elevated temperatures using Gleeble 3800 (Figure A.4.6 & A.4.7). Shear punch testing of tungsten is performed at Room Temperature, 250 °C and 500 °C.

Figure A.4.7: Tungsten samples after shear punch testing.

Tensile strength of tungsten samples are found to be 1008 MPa @ RT, 772 MPa @ 250°C and 568 MPa @ 500°C. [UTS of 544-552MPa @ 500°C as per Plansee Test Certificate.]

<u>*Material Studies:*</u> The CPP-IPR CIMPLE-PSI laboratory has undertaken a series of experiments to understand the recrystallization process of tungsten (W) in the Divertor region of the fully operational scenario of ITER tokamak. This machine can reproduce both ion-flux ($10^{24}m^{-2}s^{-1}$) and heat-flux (10 MWm^{-2}) corresponding to extreme limits incident on ITER Divertor to enable fusion relevant plasma surface interaction (PSI) issues to be investigated. Tungsten samples were exposed to helium plasma and annealed in CIMPLE-PSI up to an extreme temperature of 1866K and very high ion-fluence ($1.6\times10^{27}m^{-2}$). The exposed samples were characterized by the techniques of FIB/FESEM, EBSD and micro-hardness/nano-hardness. The observations helped to understand the role of nanometric helium bubbles in retarding the process of recrystallization. It was demonstrated that tungsten also undergoes a process of retarded softening, which is again attributed to the trapping of helium in the top exposed layer of the samples (Figure A.4.8).

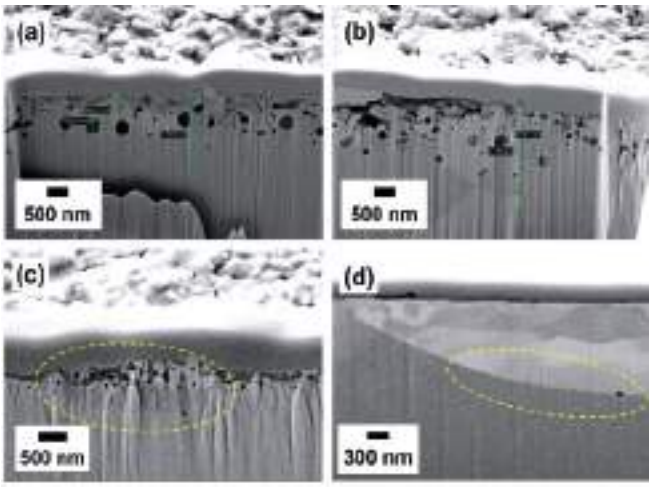


Figure A.4.8: FESEM micrographs of the FIB made cross-sections from WP1. Grain grows in micrograph, but their expansion is successfully retarded by bubbles in the rest of the situations.

<u>*Hydrogen Plasma Interaction with Tungsten:*</u> Hydrogen plasma beam from a pulsed plasma accelerator (PPA) is used to observe the plasma matter interaction relevant to fusion reactor like tokamak. The PPA is powered by a 200 kJ pulsed power system (PPS). The required gas for production of plasma beam is controlled with an electromagnetic gas injection valve (GIV). A 1 mm thick, 10 mm dia polished tungsten (W) sample fitted on Delrin holder is placed in front of the hydrogen plasma beam at a 10cm distance from the end of the electrode to study the interaction (Figure A.4.9). The samples were exposed to single as well as multiple beam shots.

Figure A.4.9: Interaction of hydrogen plasma with W sample captured by High Speed Camera 24 mm lens, exposure 75000 frame per second.

Figure A.4.10: Exposed Tungsten sample for 15 shots of hydrogen plasma.

The exposed samples are scanned under optical microscope at 100x magnification (Figure A.4.10). From the image it is seen that macro cracks are developed for 15 numbers of plasma beam exposures at the considered distance. The energy density measured at this position for a single hydrogen plasma pulse is 0.2 MJ/m^2

A.4.3 Fusion Blanket Technologies

<u>*Thermal Expansion Studies of Li_2TiO_3 by Dilatometry and In-Situ High-Temperature X-Ray Diffraction:*</u> Li_2TiO_3 material was compacted into pellets and high-temperature X-ray diffraction (HT-XRD) was employed to obtain X-ray diffraction patterns from room temperature to 1273 K at 100 K intervals. The lattice parameters (a, b, and c) of Li_2TiO_3 polycrystals were determined and corresponding unit cell volumes were estimated at each temperature. The thermal expansion percentages for the lattice parameters a, b, and c between room temperature and 1273 K were found to be 1.21%, 1.84%, and 1.83% respectively. The calculated coefficient of thermal expansion (CTE) were determined as 12.5×10^{-6} K^{-1}, 19×10^{-6} K^{-1}, and 18.9

$\times 10^{-6}$ $K^{-1}$for lattice parameters a, b and c respectively. The crystallographic density at room temperature was estimated to be 3.42 g/cm^3. The molar volume was calculated to range between 32.12 and 33.72 cm^3/mol from room temperature to 1273 K. Additionally, high-temperature dilatometry was employed to measure the thermal expansion of Li_2TiO_3, resulting in the estimation of coefficient of thermal expansion. From room temperature to 1290 K, the thermal expansion percentage and mean coefficient of thermal expansion were calculated to be 1.91% and 19.64 $\times 10^{-6}$ K^{-1}, respectively. Furthermore, the temperature dependent mean and instantaneous thermal expansion values were also determined. The differential scanning calorimetry (DSC) method was used to estimate the temperature of the monoclinic to cubic transformation, which was determined to be 1416 K.

Effect of Inlet/Outlet Height Difference on P-Q Characteristics of an Electromagnetic Pump for Heavy Liquid Metals: A permanent magnet based electromagnetic pump (EMP) has been designed and fabricated for high temperature heavy liquid metals. It has features of being bi-directional in operation and non-intrusive in technique. The EMP has been characterized by generating its pressure developed vs flow rate (P-Q) curve in a high temperature experimental set up. A systematic study has been performed to analyse the effect of gravity on P-Q curve of such pumps. A method has been proposed to accurately generate the P-Q curve for such pumps for heavy liquid metals. The generated P-Q curve has been compared with available analytical expressions and found to match well.

Heat Transfer and Fluid Flow Analysis of Pebble Bed and Its Verification with Artificial Neural Network: The advancement of sophisticated packed beds has significant implications for the development of new equipment for associated industries. Determining the heat transfer and fluid flow properties of the functional material in the form of a pebble bed is crucial during the design phase of a solid-type ceramic breeding blanket in a fusion reactor. In order to efficiently construct and operate the breeder blanket, a study has been carried out to explore the features of heat transmission and fluid flow. Initially, the heat transfer and fluid flow analyses were carried out independently to benchmark the results using models and experiments using a stainless steel pebble bed with a diameter of 2 mm. Following that, a combined simulation analysis of heat transfer and fluid flow was carried out to demonstrate the system's effective operation for Li_2TiO_3. A model of an artificial neural network (ANN) has also been employed to forecast the results. The results of simulations are within 5% of the expected values made using ANN.

A.4.4 Large Volume Cryopump and Cryoplant Technologies

Design and Development of LN2 Cooled Cryopump for Application in High Heat Flux Test Facility: An indigenously developed liquid nitrogen cooled cryopump is mounted to the High Heat Flux (HHF) test facility (Figure A.4.11). The developed cryopump has 250CF inlet flange and is mounted vertically downward to an angle port (50°) of the D-shaped vacuum chamber of the HHF facility. The pump has an integrated liquid nitrogen bath to provide stable cooling to the cryopanels and radiation shield. Cryopanels are made of copper and coated with micro-porous activated charcoal. The pump's geometrical concept is novel because it provides ease of assembly, integration and trouble free operation in horizontal and vertical direction mounting. The pump offers pumping speed of ~5106 l/s for water vapour and ~1197 l/s for nitrogen using liquid nitrogen as coolant.

Figure A.4.11: a) Pump test setup with AVS dome, b) lifting pump for integration to HHF, c) showing mounted pump and the gate valve, and d) top view of HHF chamber with integrated pump.

Operation of Sorption Cryopump (AGASTYA-500) in SST-1 Tokamak: A customized liquid nitrogen based sorption pump was designed and fabricated for the installation on the radial port of the machine to increase the pumping speed of water vapour. It comprises of activated charcoal coated panels cooled to 80 K temperature and result in the pumping of nitrogen and oxygen by adsorption at liquid nitrogen temperature. The standalone performance testing of the pump has been done including the helium leak test, operating temperature test, pressure test, pumping speed test for water vapour and the regeneration process of the pumped gases. The pumping speed of the gases up to the temperature around 150 °C, which is close to the baking conditions of the vacuum vessel of the SST-1 is ~ 26,000 l/s for water vapour at a dosing rate of ~ 2.6×10^{-2} mbar.l/s at room temperature. Following this, the pump is now installed on the radial port of the SST-1 machine as shown in figure A.4.12a. This is the first time that an 80 K soprtion cryopump has been used for pumping on the SST-1 Tokamak. The pumping of water vapour, nitrogen and impurity gases was observed during the 11 days of operation as shown in figure A.4.12b. It is observed that the partial pressure of the water vapour which was 10^{-6} mbar with TMP showed a factor of 10 reduction with the incorporation of the sorption cryopump with the existing vacuum system. A partial pressure of 1.3×10^{-7} mbar was observed in 48 h operation with PFCs at 230 ^{o}C.

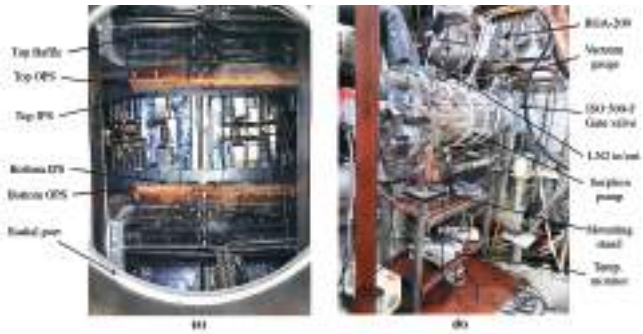


Figure A.4.12: (a) Installation of developed 80 K sorption cryopump on the radial port of SST-1.

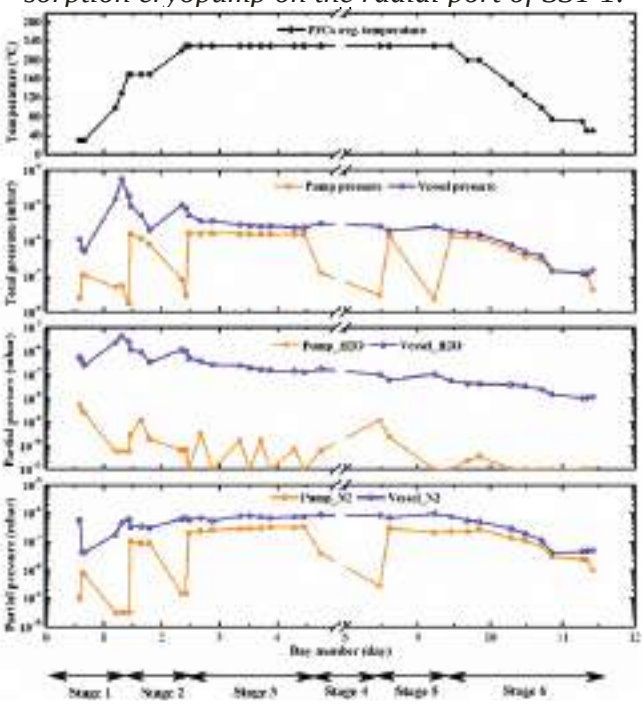


Figure A.4.12: (b) Complete baking cycle of the vacuum vessel of SST-1.

Development Status of Agastya-1250 Cryopump for SAC-ISRO Under MOU: The Space Applications Centre (SAC) of the Indian Space Research Organisation (ISRO) has a thermo-vacuum cham-

ber designed to test satellites and their components in a vacuum environment of less than 5 x10^{-6} mbar. This chamber is equipped with a commercial cryopump to achieve the required vacuum, which needs replacement. The replacement cryopump should be capable of pumping nitrogen, air, and water vapor. In response to this requirement, Institute has conceptualized and designed a cryopump named AGASTYA-1250, which is cooled by liquid nitrogen. The pump vessel houses the inner cryopump geometries and acts as a vacuum enclosure for the pump components and liquid nitrogen bath as shown in figure A.4.13. It has an inner diameter of 1308 mm and a shell thickness of 6 mm. The Liquid nitrogen bath is annulus in shape to hold the inner and outer cryopanels and provide direct conduction cooling to the panels, shields, and their supporting components. Each panel is rectangular in shape and mounted on the bath by bolting with the supports brazed to the LN_2 bath. Front array-baffles and thermal shields are also provided to minimize the radiation heat loads on the panels and to provide additional pumping surfaces for water vapour. The cryopump is designed to achieve pumping speed 1,50,000 l/s (+/- 10%) for water vapour and 45,000 l/s (+/- 10%) Air/N_2. The Detailed Design Report (DDR) of Agastya-1250 is approved by SAC-ISRO and system is under fabrication.

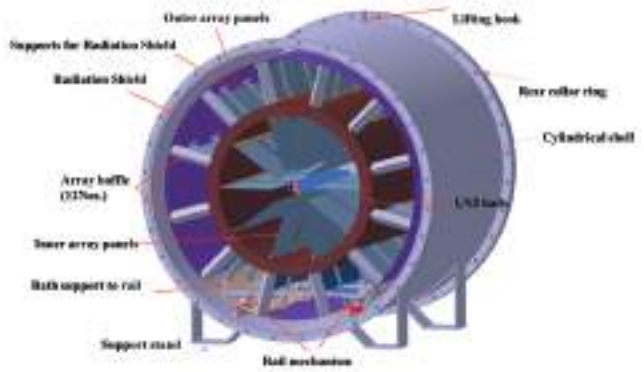


Figure A.4.13: Assembly of the cryopump (Agastya 1250) showing internal components.

Progress in Development of the Cryogenic Twin-Screw Extruder for Producing Solid Hydrogen Pellets: The Cryogenic Extruder is an extruder technology which can continuously produce solid rods of hydrogen and its isotopes. The solid rod is further cut into small cylindrical pieces called pellets which are injected at high velocity into the magnetically confined, hot plasma, for the core-fuelling and D-T reaction in long-pulse fusion reactors. Design, analysis and fabrication of the extruder is completed and its cryogenic components like pre-coolers, liquefier and solidifier (extruder) is assembled inside the vacuum chambers (Figure A.4.14).

Figure A.4.14: (a) Testing of cryogenic extruder system using gaseous helium (front view).

All the cryo-components have been tested with gaseous helium supplied at the inlet of the extruder for a desired throughput, and the temperature of < 20K is achieved at the outlet of the liquefier. The testing demonstrates the capability of the extruder system and validates the design parameter to pro-

duce solid hydrogen at the extrusion rate of 200 mm^3/s. The other components in the systems are vacuum system (TMPs and rotary), two GM cryocoolers, temperature sensors and controllers, Data acquisition system, servomotor for rotation of the screws, gear mechanism, mass flow controllers and feed through lines for the supply of cryogen, mainly liquid nitrogen.

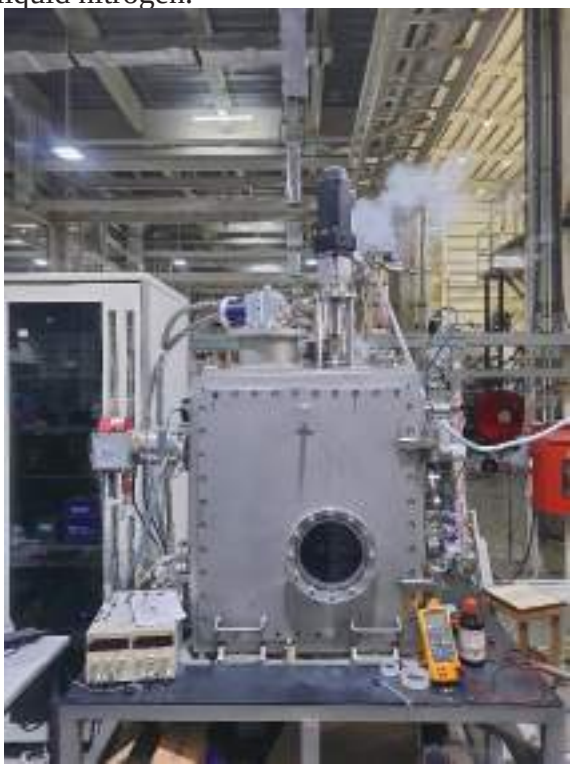


Figure A.4.14: (b) Side view of the cryogenic extruder.

The Development of a Novel Apparatus to Measure the Emissivity of High-Roughness Materials at 82 K: The knowledge of emissivity plays an important role in the estimation of radiation heat load in cryogenic systems. An apparatus is developed based on a calorimetric technique for measuring the emissivity of an opaque material around 82 K. The novelties of the apparatus are its compact size, ease of sample handling, shorter time required to reach thermal equilibrium and most importantly, capacity to measure the emissivity of a sample of high roughness. To understand the effectiveness of low and high emissivity-coated heat radiators for the system, a theoretical and an experimental approach has been followed. It is found that the high-emissivity heat radiator leads to a significant reduction in the time required to reach thermal equilibrium compared to a low-emissivity heat radiator. To verify and validate this setup, the emissivities of Aeroglaze Z306 (high emissivity) and Cu (low emissivity) are measured and compared with the values reported in the literature. Measurement of emissivity at cryogenic temperature for the first time for PU1, SG121FD and indigenously developed novel materials, such as black paints, adhesive and activated charcoals of different granule sizes have been done.

A.4.5 Remote Handling and Robotic Technologies

Articulated Robotic Inspection Arm (ARIA): The 6

Figure A.4.15: Tile handling demonstration using ARIA.

axis in-house developed ARIA arm (Figure A.4.15) has been programmed to demonstrate remote controlled tile handling scenario inside a toroidal vessel. The same has been demonstrated for the case where a tile inside the vessel was removed from its original location and placed in to the desired location using a parallel jaw gripper attached to the end of the articulated arm.

Hyper Redundant Inspection System (HyRIS): A servo control system based on EtherCAT industrial standard has been developed for the 18 axes HyRIS System mounted on a linear guide is successfully developed and demonstrated with 02 axes for various shape formations such as Star, circle etc. An UHV compatible version of the HYRIS system also has been designed (Figure A.4.16).

Figure A.4.16: (a)Hyper Redundant Inspection System (HRIS) in operation. (b) UHV Compatible version.

Haptic Force Feedback Arm: A 6 axes haptic arm has been indigenously developed where the user can feel the forces as experienced by robotic arm on their hands (Figure A.4.17). A tele-manipulation based control system has been developed and the haptic arm has been used to control an industrial ABB robot.

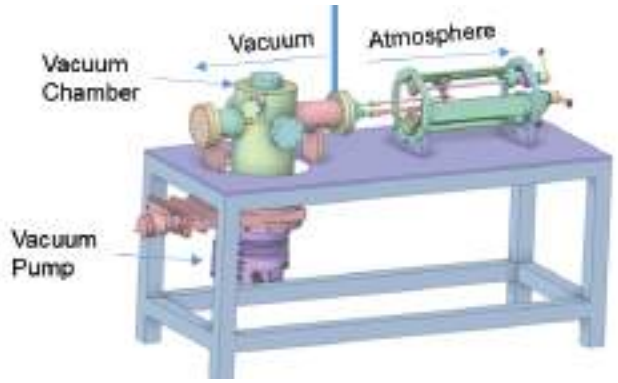


Figure A.4.16: (b) Hyper Redundant Inspection System (HRIS) UHV Compatible version.

Figure A.4.17: Haptic Force Feedback arm controlling ABB robot.

Dual Arm Manipulator: For maintenance and component handling inside tokamaks, a dual arm manipulator has been designed (Figure A.4.18). The system has been designed with a payload of 5 Kg per arm and >25 Kg payload of the central winch. It is equipped with head and hand cameras for tracking and provide visual feedback for precise movements. The integrated robot joint actuators procurement procedures are completed. The system fabrication and assembly is being planned.

A.4.6 Negative Ion Neutral Beam (NINB) Technologies

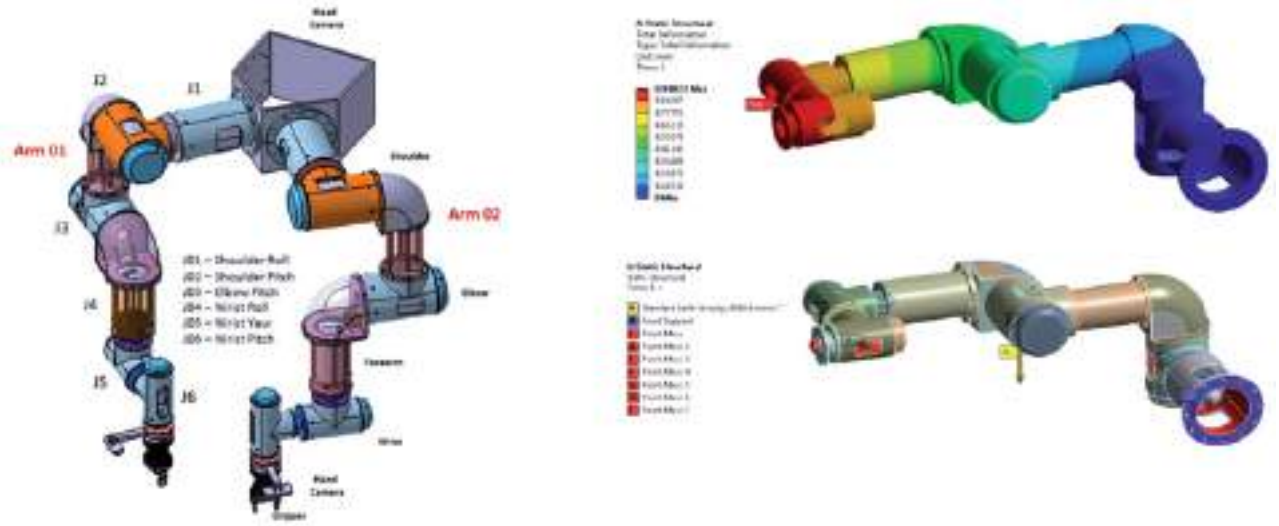


Figure A.4.18: Design & analysis of the dual arm Manipulator.

The ROBIN test bed consisting of a single driver RF based negative ion source has been used over the years to produce, accelerate and characterize H^- negative ion beams. Current densities >30 mA/cm^2 with e^-/ion ratios < 1 have been achieved. Studies related to effects of magnetic fields on the plasma asymmetries have revealed that tuning of magnetic fields in the vicinity of the filter fields helps in improving the asymmetries. The ROBIN beam line has since been upgraded to perform studies and experiments related to neutral beam production. An additional 1.5 m long, 1 m diameter SS vacuum chamber has been added to the existing vacuum chamber. Beam line components like the neutralizer and the electrostatic residual ion dump (ERID) have been designed, manufactured and installed in the beam line followed by a thermocouple instrumented calorimeter for beam characterization. An additional cryopump has been added to take care of the additional gas loads in the beam line due to active hydrogen gas feed in the neutralizer during beam operations for neutral beam production. Figure A.4.19 shows the upgraded ROBIN test bed beam line and the beam line components mounted in the vessel.

The reassembled beam line has been leak tested to ensure minimal impurities to avoid Cs contamination. Beam experiments have been initiated first in

Figure A.4.19: Upgraded ROBIN test bed with additional chamber; inside view of the beam line with neutralizer and ERID mounted in the vessel.

the ion beam mode with modified magnetic configurations. This has been followed by initiation of the neutral beam production experiments studied for various gas flows in the neutralizer and voltages on the ERID. Initial signatures of the neutral beam production have been obtained with increase in temperatures of the calorimeter thermocouple dues to the incident neutral beam and with ERID simultaneously showing current corresponding to the un-neutralised ionic beam deflected for a given applied voltage. Initial signatures show 70% beam neutralization. Detailed analysis is underway to ascertain the neutralizer gas feed dependence on beam neutralization. In this experimental campaign some limitations on the ERID power supplies in terms of voltage and current handling capability have been observed which will be taken care of in the following campaign by performing a power supply upgrade and enabling an ERID with capability to change the distance between the plates to allow electric field tunability for various beam energies.

A.4.7 Neutronics Studies

Progress on the Accelerator Based 14 MeV DT Neutron Facility: Progress continues on the accelerator based 14 MeV DT neutron facility (Figure A.4.20). An operation license has been issued by AERB for 20 mA, 340 keV energy for tritiated target of 140 Ci activity. The maximum yield achieved so far on the facility is 1.4 x 10^{12} n/s at 250 keV against the maximum design value of 5 x 10^{12} n/s.

Neutron Irradiation Impact on Structural and Electrical Properties of Polycrystalline Al_2O_3: High energy neutron irradiation impact on structural and electrical properties of alumina are studied with particular emphasis on real time in-situ radiation induced conductivity measurement in low flux region. Polycrystalline Al_2O_3 samples are subjected to high energy neutrons produced from D-T neutron generator and Am–Be neutron source. 14 MeV neutrons from D-T generator are chosen to study the role of fast neutron irradiation in the structural modification of samples (Figure A.4.20). Real time in-situ electrical measurement is performed to investigate the change in insulation resistance of Al_2O_3 due to radiation induced conductivity at low flux regime. During neutron irradiation, a significant transient decrease in insulation resistance is observed which recovers to a relative higher value just after neutron exposure is switched off. XRD results of 14 MeV neutron irradiated samples suggest annealing effect. Impact of relatively low energy neutrons on the structural properties is also studied using Am–Be neutrons. In this case, clustering is observed on the sample surface after prolonged neutron exposure. The structural characterizations of pristine and irradiated Al_2O_3 samples are performed using XRD, SEM, and EDX.

Figure A.4.20: 14 MeV DT neutron facility.

A CFD Analysis of the Rotating Target Holder of the 14-MeV Neutron Generator: A CFD-based design study has been done for an accelerator based 14-MeV neutron generator using a water-cooled rotating tritium target. The rotating target holder mainly consists of a rotating copper disc water-cooled case mounted on the rotating shaft. The high-energy deuterium ion beam impacted on solid TiT target fitted on the copper case imparting its

energy to the case. This energy is taken away from the system through the water passing through the annulus cavity of the shaft. Detailed CFD analysis has been carried out for optimizing two important parameters of the rotating target, viz. optimization of the flow parameters of the water as mass flow rate and speed optimization of the rotating target and the design of fins inside the copper case.

A5. Theoretical Modelling and Computational Plasma Physics

Several upgradations are done with high performance computing system and advanced modelling and simulation studies have been carried out related to theoretical fundamental plasma science, fusion science and technology etc.. A brief about the studies carried in the current year have been highlighted in the following subsections.

A.5.1 High Performance Computing

Pseudo-spectral Solver versus Grid-based Solver: A Quantitative Accuracy Test Using GMHD3D and PLUTO4.4: Comparison of the GMHD3D code and the PLUTO4.4 code for both two and three dimensional hydrodynamic and magnetohydrodynamic problems is done. The open-source finite-volume solver PLUTO4.4 and the in-house developed pseudo-spectral multi-GPU solver GMHD3D both can be used to model the dynamics and turbulent motions of astrophysical plasmas. Although GMHD3D and PLUTO4.4 utilize different implementations, it is found that simulation results for hydrodynamic and magnetohydrodynamic problems, such as the rate of instability growth, 3-dimensional turbulent dynamics, oscillation of kinetic & magnetic energy, and recurrence dynamics, are remarkably similar. However, it is seen that the pseudo spectral solver GMHD3D is significantly more superior than the grid based solver PLUTO4.4 for certain category of physics problems.

A.5.2 Nonlinear Plasma Theory and Simulation

Spatio-temporal Evolution of Upper-hybrid Oscillations in Inhomogeneous Magnetic Field: Spatio-temporal evolution of large amplitude upper hybrid oscillations in an inhomogeneous magnetic field is studied analytically and numerically using the Dawson sheet model. It is observed that the inhomogeneity in magnetic field causes the upper hybrid frequency to acquire a spatial dependence, which results in phase mixing and subsequent breaking of the upper hybrid oscillations at arbitrarily low amplitudes. This result is in sharp contrast to the usual upper hybrid oscillations in a homogeneous magnetic field where the oscillations break within a fraction of a period when the amplitude exceeds a certain critical value. The phase mixing (wave breaking) time is seen analytically to scale inversely with the amplitude of magnetic field inhomogeneity and amplitude of imposed density perturbation, and to scale directly with the ratio of magnetic field inhomogeneity scale length to imposed density perturbation scale length. Simu-

lation results on phase mixing time obtained using a 1-1/2 D code based on Dawson sheet model are found to be in good agreement with the analytical scaling. The result has relevance to plasma based particle acceleration experiments in the presence of a transverse inhomogeneous magnetic field.

Development of MHD Code: A numerical code that includes the Hall EMF term in MHD has been developed. This code treats plasma as Quasi-Neutral-Two fluid problem and is based on finite volume method for hyperbolic problems. The 2D version of the code has already been developed and benchmarked against standard problems like Brio-Wu Shock Tube problem, and Orszag-Tang Vortex. Presently development of 3D version of the code is in progress. The development of modules related to evaluation of fluxes, evaluation of current density, determination of maximum velocity of signal in code, and the Riemann solver (HLL) have been completed.

Study of Subcritical Turbulence Studies in Yukawa Liquids: Plane Couette Flows (PCFs) in 3D are known to be linearly stable. However, when perturbed nonlinearly (i.e, with finite amplitude) and with certain spatial structure of perturbations, PCFs are known to become nonlinearly unstable in Hydrodynamics. Using 3D Yukawa liquids as working medium, the subcritical turbulence nature of 3D Yukawa liquid was investigated using an in-house developed 3D GPU based MD code (MPMD-3D). The findings indicate that the subcriticality is indeed observed in Yukawa liquid. Importantly the role of interaction range on the nature of spatio-temporal structure of turbulence was elucidated.

Study of Yukawa Liquids Made of "Active Particles": As against "passive" matter where energy is normally injected at largest possible scales (for e.g. stirring of a tea cup), in "active" matter, the energy is injected at smallest scales (for e.g. a pool of bacteria or a school of fish). In systems with many degrees of freedom, at slow time scales and relatively Statistical Mechanics of a collective of such active particles is an important area of study and is presently a hot topic world-wide. Using a collection of active particles which interact via a Yukawa interaction, the physics of Motility Induced Phase Separation (MIPS) and related phenomenology is studied using an in-house developed Molecular Dynamics code for active particles (MPMD2D-A).

The following problems have been addressed:

1. A system of non-interacting active particles in a rocking ratchet setting: In this problem, the role of translational noise on the rectification and current reversal of particles by exploring a phase diagram in the parameter space of translational noise and driving frequency for two different strengths of rotational diffusion has been investigated.

2. A system of self-aligning soft active disks: The studies have been performed in a semi-confined geometry for varying channel width and alignment strength. The effect of the confinement giving rise to different aggregate morphologies has been studied using structural and dynamic properties

Phase-space Vortices: 1D Vlasov-Poisson Studies: The studies related to the evolution of linear as well as non-linear (large amplitude) electron plasma wave (EPW) in the presence of simple immobile spatial ion equilibrium non-uniformity (constructed without any approximation) for different regimes and phenomena such as mode coupling, Landau damping, particle trapping and de-trapping, trapped particle instability (TPI) and their interplay have been performed. Further, role of the system size on the temporal dynamics of the

long wavelength linear EPW mode has also been studied. Furthermore, numerical experiments have been carried out to investigate the dynamics of driven electron plasma waves in the presence of immobile as well as kinetic inhomogeneous ions and coupling of externally driven EPW mode to the plasma bulk.

Ion-Driven Destabilization of a Toroidal Electron Plasma—A 3D3V PIC Simulation: Ion-driven destabilization of a toroidal electron-plasma in a small aspect ratio axisymmetric toroidal device is studied for Ar^+ ions of different initial density values using a high fidelity 3D3V PIC solver. Stability of a recently discovered quiescent quasi-steady state (QQS) of a toroidal electron plasma obtained from "seed" solution, due to entropy extremization at zero inertia, is addressed in the presence of a small ion population. An initial value (f_0) of the ion fraction ($f = n_i/n_e$) and the corresponding secondary electrons are "pre-loaded" into the system after the electron plasma attains a QQS state. This procedure is regarded as a proxy to the conventional production of ions in the experimental devices via impact ionization. The resulting electron plasma exhibits destabilized "center of charge motion" (m = 1) along with higher order harmonics with dominant power in the second harmonic. Gradual loss of ions (and also electrons) is observed resulting in time varying f values. Beyond a certain value of f_0 (≥ 0.005), growth in wall probe current is observed, which saturates at later simulation time due to the loss of particles. Trajectories of ion particles indicate ion trapping in the potential well is qualitatively similar to the ion resonance instability in pure electron plasmas.

Secondary Electron Emission and Collisional Effects in a Two-Electron Temperature Plasma Sheath: The effects of secondary electron emission from the surface of a material that is in direct contact with a plasma containing two different electron groups have been investigated based on the hydro-dynamic sheath model. The two-electron groups present in the system have distinct densities and temperatures. They are described by the non-extensive distribution function, whereas cold ions are assumed to be fluid elements. In addition, the effect of ion-neutral collision has also been taken into account. The study reveals that the electron non-extensivity has a significant effect on the secondary electron population as well as space charge deposition near the wall. The results obtained from the study provide a better understanding of the plasma-wall transition region under an electron-emitting condition.

Revisiting Kinematic Fast Dynamo in Three-Dimensional, Magnetohydrodynamicplasmas: Dynamo Transition from Non-Helical To Helical Flows: Dynamos wherein magnetic field is produced from velocity fluctuations are fundamental to the understanding of several astrophysical and/or laboratory phenomena. Though fluid helicity is known to play a key role in the onset of dynamo action, its effect is yet to be fully understood. In this work, a fluid flow proposed recently is invoked such that one may inject zero or finite fluid helicity using a control parameter, at the beginning of the simulation. Using a simple kinematic dynamo model, for the considered flow, a strong dependency of short scale dynamo on fluid helicity has been demonstrated. In contrast to conventional understanding, it is shown that fluid helicity does strongly influence the physics of short scale dynamo for the flow profiles considered. To corroborate these findings, late time magnetic field spectra for various values of injected fluid helicity is studied along with geometric signatures of the 3D magnetic field surfaces, which shows a transition from 'twisted ribbon' or 'twisted sheet' to 'cigar' like configurations. The work brings out, for the first time, the role of

fluid helicity in the transition from 'non-dynamo' to 'dynamo' regime systematically. It is also seen that one of the most studied ABC dynamo model is not the fastest dynamo model for problems at lower magnetic Reynolds number

Kinetic Simulation of a 50 mTorr Capacitively Coupled Argon Discharge over a Range of Frequencies and Comparison to Experiments: The effect of driving frequency in the range of 13.56–73 MHz on electron energy distribution and electron heating modes in a 50 mTorr capacitively coupled argon plasma discharge is studied using 1D-3V particle-in-cell simulations. Calculated electron energy probability functions exhibit three distinct "temperatures" for low, mid, and high energy electrons at all the studied driving frequencies. When compared to published experimental data, the calculated probability functions show a reasonable agreement for the energy range resolved in the measurements (about 2–10 eV). Discrepancies due to limitations in experimental energy resolution outside this range lead to differences between computational and experimental values of the electron number density determined from the distribution functions, and the predicted effective electron temperature is within 25% of experimental values. The impedance of the discharge is interpreted in terms of a homogeneous equivalent circuit model, and the driving frequency dependence of the inferred combined sheath thickness is found to obey a known, theoretically derived, power law. The average power transferred from the field to the electrons (electron heating) is computed, and a region of negative heating near the sheath edge, particularly at higher driving frequencies, is identified. Analysis of the electron momentum equation shows that electron inertia, which on temporal averaging would be zero in a linear regime, is responsible for negative values of power deposition near the sheath edge at high driving frequencies due to the highly nonlinear behavior of the discharge.

Role of Translational Noise on Current Reversals of Active Particles on Ratchet: In this study, the role of thermal fluctuations on the rectification of non-interacting inertial active (self-propelled) particles in a rocking ratchet setup in the absence and in the presence of the external time periodic drive has been explored using Langevin dynamics simulations,. The system is first studied in the absence of the external drive. It is found that the average velocity is always positive and a peaked function of the translational noise, indicating that the asymmetry effects dominate at intermediate values of the strength of the thermal noise. In the second part of this work, the effect of the external drive on the dynamics of the system is studied by exploring a phase diagram in the parameter space of translational noise and driving frequency for two different strengths of rotational diffusion. For a given constant amplitude of the active force and amplitude of external drive less than the maximum force due to the potential, the average velocity magnitude as well as the direction is found to depend on the rotational diffusion, frequency of the external drive and the strength of the translational noise. The current reversal is seen to happen for certain critical parameters in the phase space. It is found that when the average particle energy is lower than the potential energy of the barrier, symmetry breaking dominates and the currents are in the 'easy' direction of the ratchet. On the other hand, when the energy available per particle crosses the potential energy of the barrier, the competition between inertial effects and diffusion effects decides the direction of currents. The findings have been explained by constructing phase difference datum, velocity probability distribution, and current probability analyses. The results provide a novel method for controlling the direction of transport of inertial active particles.

Direct Implicit and Explicit Energy-Conserving Particle-In-Cell Methods for Modeling of Capacitively Coupled Plasma Devices: Achieving large-scale kinetic modeling is a crucial task for the development and optimization of modern plasma devices. With the trend of decreasing pressure in applications, such as plasma etching, kinetic simulations are necessary to self-consistently capture the particle dynamics. The standard, explicit, electrostatic, momentum-conserving particle-in-cell method suffers from restrictive stability constraints on spatial cell size and temporal time step, requiring resolution of the electron Debye length and electron plasma period, respectively. This results in a very high computational cost, making the technique prohibitive for large volume device modeling. The direct implicit algorithm as standard approach and the explicit energy conserving algorithm as alternatives to the standard approach have been studied, both of which can reduce computational cost with a minimal (or controllable) impact on results. These algorithms are implemented into the well-tested EDIPIC-2D and LTP-PIC codes, and their performance is evaluated via 2D capacitively coupled plasma discharge simulations. The investigation reveals that both approaches enable the utilization of cell sizes larger than the Debye length, resulting in a reduced runtime, while incurring only minor inaccuracies in plasma parameters. The direct implicit method also allows for time steps larger than the electron plasma period; however, care must be taken to avoid numerical heating or cooling. It is demonstrated that by appropriately adjusting the ratio of cell size to time step, it is possible to mitigate this effect to an acceptable level.

Nonlinear Interaction of Electromagnetic Wave with Electron Acoustic Wave in Plasma: An analysis on the nonlinear interaction of electromagnetic waves with electron acoustic waves is performed in plasma with two different temperature electron fluids in the presence of a neutralizing static ion background. A newly structured Zakharov equations are derived by employing two fluid two-time scale theory. These coupled Zakharov equations describe the weakly nonlinear interaction of em wave perturbation with electron acoustic waves while propagating through plasma. In the low frequency or adiabatic limit, these Zakharov equations may be unified to produce a modified Non Linear Schrodinger Equation (NLSE). A solution of the equation, novel in the literature, is derived following the method shown by Kudryashov. In a resonant regime, the modified NLSE reduces to NLSE. Though a stable solution exists for both cases, instability analysis shows that caviton instability may arise. The threshold value of the electric field, at which instability sets in, is virtually zero for the resonant region whereas, apart from that region there is a threshold value of the electric field, determined by the frequency difference of em wave and electron plasma wave. Experimental observations support these results. This study is relevant for laser-plasma interaction and astrophysical and space plasma.

A Harmonic Study of Electric Field Nonlinearity and Field Reversal in Collisionless Capacitive Discharges Driven By Sawtooth-Like Waveforms: The collision less argon discharge excited by temporally asymmetric sawtooth-like waveform have been investigated using particle-in-cell simulation technique. In particular, a systematic study of the electric field nonlinearity and field reversal phenomenon by varying the number of harmonics and its effect on electron and ion heating is performed. The simulation results predict higher harmonics generation and multiple field reversal regions formation with an increasing number of harmonics along with the local charge separation and significant displacement current outside sheath region. The field reversal strength is greater during the

expanding phase of the sheath edge in comparison to its collapsing phase causing significant ion cooling. The observed behavior is associated with the electron fluid compression/rarefaction and electron inertia during expanding and collapsing phase respectively.

Turbulent Spot Formation in Stably Stratified Three-Dimensional Yukawa Liquids: A plane-Couette flow (PCF) is considered in a stably stratified three-dimensional (3D) Yukawa liquid, perturbed initially with a finite amplitude 3D perturbation. Stable stratification in density is achieved by subjecting the medium to external gravity. Turbulent spot formation in a stably stratified PCF is observed. The dynamics of the system is shown to depend upon the value of κ, which is associated with the range of interaction. This study involves "first principles" classical 3D molecular dynamics (MD) simulations for "hypergravity" ($1.3g0$, $g0$ is Earth's gravitational force for unit mass in our normalized unit) and "milligravity" ($9\times10^{-3}g0$) cases for κ, 1.0 and 4.0, respectively. The relevant fluid quantities from MD data are extracted. For the hypergravity case, when the system is evolved in time under stable stratification, the kinetic energy is observed to deposit in the lower wave vectors (K_x, K_z), leading to "inverse cascade" in the plane perpendicular to the direction of stratification. As a result, one observes large-scale structure formation in velocity and streamwise vorticity fields. Nucleation of velocity streak is observed for the first time in the stably stratified case in our simulation. The coherent structures in the velocity and streamwise vorticity fields are found to sustain for longer period of time for the stably stratified cases as compared to the unstratified case. The large-scale dynamics is observed to enhance for the miligravity case. Unlike unstratified PCF, a background flow in Y-averaged streamwise fluid velocity field is observed for the stably stratified case. The obtained results using "first principles" classical MD simulations on subcritical turbulence in stably stratified Yukawa liquid, may have ramifications to wider class turbulence problems.

A.5.3 Tokamak and Fusion Reactor Studies

MHD Studies in Tokamak: SOL and Blobs: Edge and SOL plasma turbulence in tokamak plasma has been studied. Plasma blob formation physics in the presence of velocity shear has been reviewed. The impact of edge biasing on the cross-field transport and power spectra in the edge and SOL regions of a tokamak have been addressed. Medium-Z (N_2, Ne, Ar) impurity transport in a tokamak has also been studied. Ion temperature dynamics on the role of gyro-viscosity and vorticity has been addressed.

Gyro-kinetic studies:

Transport due to Short-wavelength ITG and Trapped Electron Modes in ADITYA-U Tokamak: Recent gyro-kinetic simulations, using ORB5 with non-adiabatic ions and adiabatic electrons, reveal the coexistence of Short Wavelength ITG (SWITG) mode with the conventional ITG mode due to sharp temperature and density gradients in ADITYA-U. However, in plasmas confined by inhomogeneous magnetic fields, some electrons get trapped in low magnetic field regions. These trapped electrons can either enhance micro-instabilities from ion dynamics, such as the ITG-TE (ITG coupled with trapped electron) mode, or generate other instabilities known as trapped particle modes. Numerical simulations using gyrokinetic codes indicate that larger elongations and higher triangularity (at high elongations) have a stabilizing effect on ITG-AE (ITG with adiabatic electron) and ITG-TEs. Trapped electron coupled ITG-driven turbulence and the effect of magnetic equilibrium shaping (elongation and triangularity) on conventional ITG and

SWITG modes have been studied using a global gyro-kinetic simulation with a real MHD equilibrium in the ADITYA-U.

Universal Drift Modes: Universal Drift Modes (UDM) have been investigated for Lithium Tokamak Experiment (LTX) like parameters and profiles. UDMs were studied using global gyro-kinetic, electrostatic, linear simulations with ORB5 code and a mixing length estimate was calculated for the same. Along with UDM, Ubiquitous modes (UM) which is Trapped electron mode (TEM) driven by density gradient for high mode numbers were studied using global, gyro-kinetic, linear spectral code GLOGYSTO. UM's dependence study on various parameters like, R/L_n ratio,η (L_n/L_t), shear, (T_e/T_i) were also carried out using GLOGYSTO code. Non-linear study of UDM is to be conducted next using ORB5 code for LTX-like parameters and profiles. After that, real magnetic equilibrium constructed using CHEASE code for LTX is to be used for studying UDM by performing linear and non-linear gyro-kinetic simulations with ORB5 code.

Studies in Pure Electron Toroidal Plasmas at Tight Aspect Ratios: A set of three numerical experiments are conducted by loading the axisymmetric toroidal electron cloud at varying major-radial distances from the central axis at the vertical mid plane. It is demonstrated that relatively better confinement of electron plasma is achieved by loading the initial plasma at the vertical midplane, close to the inner wall of the chamber, supporting mean-field theoretical predictions. Following this, the existence of a quiescent quasi-steady state in an axisymmetric toroidal trap is demonstrated using combination of a mean field theoretic extrema entropy solution and inertia effects in Particle-in-Cell simulation. It is demonstrated that the global particle confinement time for this novel state is typically greater than 106 times the so-called toroidal Diocotron time. Further, role of ions is investigated based on collision-less (preloaded ion) and collisional mechanisms which suggests that the quiescent state discovered may suffer toroidal ion resonance-like instability, which is found to grow algebraically in time. Furthermore, the numerical experiments discussed earlier for axisymmetric toroidal trap is performed in a 3D non-axisymmetric toroidal trap with electrostatic end plugs. To investigate the electron dynamics under similar conditions as typical experimental devices, further studies have also been performed in non-axisymmetric toroidal traps, resulting in a new empirical scaling law for the toroidal Diocotron frequency as a function of mean density.

Hydrodynamics and MagnetoHydroDynamics:

MHD - Magnetic Island Coalescence: By using a relatively simple 2D/2.5D ViscoResistive-MagnetoHydroDynamic (VRMHD) model, the effect of shear flows during the coalescence of two magnetic islands is investigated. The role of island width, effect of scale of in-plane and out-of-plane sheared flow, role of compressibility on the MR dynamics in CS and the overall reconnection mechanism during the island coalescence instability has been studied. Further, two different class of Fadeev equilibrium have been addressed namely, non-force-free and force-free equilibrium. These problems are addressed using BOUT++ and MPI-AMR-VAC codes.

MHD – Dynamo: The work brings out, for the first time, the role of fluid helicity in the transition from `non-dynamo' to `dynamo' regime systematically. Using a simple kinematic dynamo model, it has been seen that short-scale dynamo is highly dependent on fluid helicity for the considered flow. To corroborate these findings, late time magnetic field spectra for various values of injected fluid

helicity along with ``geometric'' characteristics of the 3D magnetic field iso-surfaces are considered. These reveal a transition from `twisted ribbon' or `twisted sheet' to cigar like configuration. The impact of flow shear on the dynamo mechanism has also been investigated. For helical flows, the numerical observations imply that shear has the effect of suppressing the small scale dynamo (SSD) action, but for non-helical base flows, flow shear has the reverse impact, magnifying the SSD activity. For non-helical base flows, the rate of increase in magnetic energy is found to be flow shear scale-independent and to take some algebraic form. The generalizability of these results has been tested by studying non-helical base flows with a variety of shear profiles and scale lengths.

A.5.4 Fundamental Plasma Studies

Plasma Thrusters: Computer Simulation and Modeling: During the previous year, a cylindrical RZ 2D3V PIC-MCC solver with arbitrary boundary conditions was developed and this solver was well bench-marked with available test problems. We had investigated the ion thrust generation for Argon fuel gas having different parameters like fuel density and magnetic field gradient in the plasma expansion region. In a real working thruster, Xenon is the fuel gas. Iodine is also a promising fuel candidate due to its unique features. We have simulated plasma expansion physics and thrust generation for Iodine and Xenon gas. Due to high mass, these gases cause high thrust for a given density as compared to Argon. The cylindrical 2D3V PIC-MCC code has been upgraded to include electron heating mechanism. A pseudo heating method has been used and full Maxwell's equations for a given coil current have been solved in a relevant frequency domain. The real part or imaginary part of final equation have been used to estimate the electric field component which causes acceleration of the charge particle.

Simulations on the Effects of Higher Frequencies of RF on Capacitively Coupled Plasma (CCP): In semiconductor industries, achieving uniform deposition or etching across the entire substrate requires precise control over critical sheath plasma parameters like ion flux and ion energy. In conventional Capacitively Coupled Plasma (CCP) devices, the discharge are produced by single frequency Radio Frequency (RF) source, often having frequency of 13.56 MHz. However, in recent industrial applications, there is a growing interest in capacitive discharges excited by tens of megahertz, or even higher. This higher frequency range is beneficial for enhancing the plasma processing rates while minimizing substrate damage across a broad area of the wafer substrate. Recently, a computational study of experimental results in CCP argon discharges using the Particle-in-Cell (PIC) methods at 50 mTorr and driving frequencies from 13.56 MHz to 73 MHz has been performed. The results indicated that the power deposition increases with increasing frequency in the sheath due to enhanced heating of electrons at high driving frequencies. The physics of production of fast electron beams due to the nonlinear dynamics of the sheath and the negative electron power absorption is also understood. The analysis showed that electron inertia in combination with harmonic generation plays a significant role, in an overall average negative power deposition near the sheath edge.

Gyrokinetic Simulations of Electrostatic Microturbulence in ADITYA-U Tokamak: Global gyrokinetic simulations of the electrostatic micro-turbulence driven by the pressure gradients of thermal ions and electrons are carried out for the ADITYA-U tokamak geometry using its experimental plasma profiles and with collisional effects. The dominant instability is trapped electron mode (TEM) based

on the linear eigen-mode structure and its propagation in the electron diamagnetic direction. Collisional effects suppress turbulence and transport to a certain extent. Zonal flow does not play a critical role in the TEM saturation, which is dominated by the inverse cascade. The frequency spectrum of the electrostatic fluctuations is found to be in broad agreement with the experimentally recorded spectrum in the ADITYA-U, with a bandwidth ranging from ~0 to 50 kHz.

Lane Formation in 3D Driven Pair-Ion Plasmas: Parallel External Forcing: Lane formation dynamics of driven three-dimensional pair-ion plasmas (PIP) is investigated. Extensive Langevin dynamics simulation is performed to study the influence of an external electric field on the behaviour of the PIP system. In this model, one half of the particles are pushed into the field direction by an external force FA while the other half are pulled into the opposite direction by an external force FB. It is seen that if FA and FB are parallel, the system undergoes a non-equilibrium phase transition from a disordered state to a lane formation state parallel to the field direction with increasing field strength. The lanes are formed by the same kind of particles moving collectively with the field. The lane order parameter has been implemented to detect phase transition. Further, the lane formation in the presence of a time-varying external electric field has also been studied. In particular, the effect of parallel forces are investigated. Unlike the previously reported two-dimensional case, for the time-varying electric field case, spontaneous formation and the breaking of lanes are not observed for all values of applied frequencies; however, the orderness varies and spontaneous formation and breaking of lanes is observed for values close to a critical frequency ωc. Further, some aspects of the lane formation dynamics of a PIP system are also studied in the presence of an external magnetic field, which reveal that the presence of an external magnetic field accelerates the lane formation process and introduces a drift of the lanes in a direction perpendicular to both electric and magnetic fields.

3D Thermo-Fluid MHD Simulation in a Complex Flow Geometry: In the Magneto-hydrodynamic (MHD) flow, electric current induces inside the fluid domain due to induced e. m. f when an electrically conducting fluid flows in presence of transverse magnetic field. In this work, the 3D thermo-fluid MHD analysis has been performed for the flow geometry, which is to be tested in the liquid lead lithium MHD (LLMHD) loop. The chosen flow geometry consists of inlet/outlet circular pipes, manifolds and three rectangular channels with parallel flow configurations. Here, three rectangular channels are coupled at the inlet/outlet manifold. Sudden expansion and contraction occurs at the inlet and outlet manifold respectively. The 3D thermo-fluid MHD analysis result at magnetic field of 1.4T and flow rate of 3 kg/s has been studied in terms of the induced electric potential, electric current, pressure, temperature and flow distributions. The inlet/outlet circular pipes and manifolds are found to be the main contributors of the total pressure drop. The impact of magnetic field on flow distribution among the flow channels with parallel flow configurations has also been studied.

Spatial Flux and Energy Asymmetry in a Low Pressure Capacitively Coupled Plasma Discharge Excited By Sawtooth Waveform: A Harmonic Study: Plasma asymmetry generation in capacitively coupled plasma (CCP) discharges provides control over vital parameters that are useful in many plasma processing applications. In this study, using the particle-in-cell simulation technique, the spatial plasma asymmetry creation by a temporally asymmetric (sawtooth) waveform by varying its number of harmonics (N) has been investigated. The simu-

lation results predict a non-linear increase in the plasma density and ion flux with an increase in N, i.e., it first decreases, reaching to a minimum value for a critical value of N and then increases almost linearly with a further rise in N. The ionization asymmetry increases with N, and higher harmonics on the instantaneous sheath position are observed for higher values of N. These higher harmonics generate multiple ionization beams that are generated near the expanding sheath edge and are responsible for an enhanced plasma density. The ion energy distribution function (IEDF) depicts a bi-modal shape for different values of N. DC self-bias is observed on the powered electrode, its magnitude with respect to the plasma potential decreases with increasing N, and therefore, the corresponding ion energy on the powered electrode decreases. The results conclude that by changing N of a sawtooth waveform in a collisionless CCP system, the ion flux asymmetry is not altered, whereas sheath symmetry could be significantly affected causing a systematic variation in the ion energy asymmetry. Due to an increase in the higher harmonic contents in the sawtooth waveform, a transition from broad bi-modal to narrow-shaped IEDFs is found.

Plasma Sheath with Multi-Species of Positive Ions and Surface Produced Negative Ions: The structure of a plasma sheath has been investigated in front of a caesium-coated metallic plate, using a simple theoretical model. Along with the electrons, the plasma is composed of multi-species of positive ions, and surface and volume produced negative ions. While the volume produced negative ions are common in many plasma processing chambers, the surface produced negative ions are of critical importance, especially to the Neutral Beam Injection (NBI) systems. The surface negative ions are produced via the coated metallic plate. With a single species of positive ion, the Bohm criterion, which determines the sheath edge potential, is multi-valued for a specific range of electronegativity. The width of the multi-valued region has been reported to increase with the surface production yield. Calculations are done for hydrogen plasma with a slight admixture of a second gas such as argon. The differences brought in by the mere presence of a second ion have been studied. Additionally the importance of the positive ion current density in determining the Bohm criterion and the effect of three species of positive ions in the surface production process have also been studied.

Discharge Characteristics of a Low-Pressure Geometrically Asymmetric Cylindrical Capacitively Coupled Plasma with an Axisymmetric Magnetic Field: The discharge characteristics of a low-pressure geometrically asymmetric cylindrical capacitively coupled plasma discharge with an axisymmetric magnetic field generating an $E \times B$ drift in the azimuthal direction has been studied in this work. Vital discharge parameters, including electron density, electron temperature, DC self-bias, and electron energy probability function (EEPF), are studied experimentally for different magnetic field strength (B) values. A transition in the plasma parameters is observed for a specific range of magnetic fields where the discharge is highly efficient with lower electron temperature. Outside this range of magnetic field, the plasma density drops, followed by an increase in the electron temperature. The observed behavior is attributed to the transition from geometrical asymmetry to magnetic field-associated symmetry due to reduced radial losses and plasma confinement in the peripheral region. The DC self-bias increases almost linearly from a large negative value to nearly zero, i.e., it turns into a symmetric discharge. The EEPF undergoes a transition from bi-Maxwellian for unmagnetized to Maxwellian at intermediate B and finally becomes a weakly bi-Maxwellian at higher values of B. The above transitions present a novel way to indepen-

dently control the ion energy and ion flux in a cylindrical capacitively coupled plasma system using an axisymmetric magnetic field with an enhanced plasma density and lower electron temperature that is beneficial for plasma processing applications.

Whistler Heat Flux Instability Governed Interaction of Anisotropic Beam Electrons in Electromagnetic Vlasov Simulations: The kinetic instability of whistlers in a warm plasma, arising from electron temperature anisotropy with respect to directions parallel and perpendicular to the magnetizing field, is studied. Whistlers resonantly interacting with the electron beams, for example, the fast electrons accelerated by strong parallel electric fields and the so-called runaway electrons in a tokamak, are strong players in the scheme of thermalization of stellar winds and mitigation of fast electrons in tokamak disruption events. As an evidence of their role in runaway mitigation, most fusion plasma experiments are found to show a threshold magnetic field strength for the generation of runaways. In many of these examples, the faster primary runaways produce a secondary runaway beam having an avalanche-like non-thermal velocity distribution. The electromagnetic Vlasov simulations presented here self-consistently examine the collisionless interaction of anisotropic electron beams, including an avalanche-like beam distribution, with parallel propagating whistlers and dependence of this process on the magnetic field strength. Analysis of the interaction process includes comparison with the simulations done using more analytically accessible anisotropic bulk and beam electron distributions, namely, the bi-Maxwellian and bi-kappa, for the reference.

Investigation of EDF Evolution and Charged Particle Transport in E × B Plasma Based Negative Ion Sources Using Kinetic Simulations: A spatially varying transverse magnetic filter field (TMF) is present in an ExB plasma-based negative ion source to improve negative ion yield. The TMF strength ranges from 1 to 10 mT, causing the plasma electrons to become magnetized while leaving the ions either unmagnetized or partially magnetized. As a consequence, plasma drift, particle trapping, double layer (DL), and instabilities are observed in a negative ion source. The transport of plasma through the TMF is influenced by these phenomena, subsequently affecting the energy distribution functions (EDFs) of both electrons and ions in the plasma. Measurement of EDFs in such systems is a challenging task due to the presence of a strong magnetic field. To address this, a 2D-3V Particle-in-Cell Monte Carlo Collision (PIC MCC) model is employed to study the spatio-temporal evolution of the EDFs separately for electrons and ions. The electron EDF (EEDF) remains Maxwellian, while ion EDF (IEDF) gradually transitions to non-Maxwellian as measurements are taken closer to the TMF region. The present study reveals that the IEDF is more sensitive to the operational conditions compared to the EEDF, as evidenced by the changes observed in both EDFs under different plasma operational conditions.

Effect of Flow Shear on the Onset of Dynamos: Understanding the origin and structure of mean magnetic fields in astrophysical conditions is a major challenge. Shear flows often coexist in such astrophysical conditions, and the role of flow shear on the dynamo mechanism is of great interest. In this work, a direct numerical simulation study of the effect of flow shear on dynamo instability for EPI2D flows with controllable mirror symmetry (i.e., fluid helicity) is considered. The numerical observations suggest that for helical base flows, the effect of shear is to reduce the small-scale dynamo (SSD) growth rate moderately. For non-helical base flows, flow shear has the opposite effect of amplifying the SSD action. The magnetic energy growth rate (γ)

for non-helical base flows has been found to follow an algebraic nature of the form, where real constants, S is the shear flow strength, and γ is found to be independent of the scale of flow shear. Studies with different shear profiles and shear scale lengths for non-helical base flows have been performed to test the universality of this finding.

Study of a Collisionless Magnetized Plasma Sheath with Nonextensively Distributed Species: The properties of an atmospheric-pressure collisional plasma sheath with nonextensively distributed electrons and hypothetical ionization source terms are studied. The Bohm criterion for the magnetized plasma is extended in the presence of an ion–neutral collisional force and ionization source. The effects of electron nonextensive distribution, ionization frequency, ion–neutral collision, magnetic field angle and ion temperature on the Bohm criterion of the plasma sheath are numerically analyzed. The fluid equations are solved numerically in the plasma–wall transition region using a modified Bohm criterion as a boundary condition. The plasma sheath properties such as charged particle density, floating sheath potential and thickness are thoroughly investigated under different kinds of ion source terms, contributions of collisions, and magnetic fields. The results show that the effect of the ion source term on the properties of atmospheric-pressure collisional plasma sheath is significant. As the ionization frequency increases, the Mach number of the Bohm criterion decreases and the range of possible values narrows. When the ion source is considered, the space charge density increases, the sheath potential drops more rapidly, and the sheath thickness becomes narrower. In addition, ion–neutral collision, magnetic field angle and ion temperature also significantly affect the sheath potential profile and sheath thickness

A.5.5 LASER Plasma Interaction

Laser Plasma/Cluster interaction studies: On the generation of a mono-energetic relativistic narrow electron beam: In an earlier study numerical simulations using 3D-particle-in-cell (PIC) simulations of laser interaction with a deuterium nano-cluster in an ambient magnetic field (B_0) was performed. It was shown that absorption of laser light occurs in two stages via anharmonic resonance (AHR) and electron-cyclotron resonance (ECR) processes. The auxiliary magnetic field enhances the coupling of the laser field to cluster-electrons via improved frequency-matching for ECR as well as phase-matching for the prolonged duration of the 5 fs (FWHM) few-cycle broadband laser pulse. As a result, the average absorbed energy per electron significantly jumps near 36 − 70 times of it's ponder motive energy.

The present work focusses on studies related to the energy dispersion of such energetic electrons and their angular distribution in the position/momentum space. For bigger clusters, at high intensities, it has been shown that absorption per electron remains similar to a small cluster of radius ~ 2 nm, but total energy absorption increases almost linearly with increasing cluster (target) size due to the greater number of available energy carriers (electrons). In all cases, near ECR, electrons form a narrow cone-like weakly relativistic gyrating beam about the ambient magnetic field within an angular spread of less than 5 degree and propagate far beyond 200 times the cluster radius along the direction of the magnetic field. Such an intense, relativistic electron beam has wide applications, including the fast ignition technique for the inertial confinement fusion, ultra-short X-ray sources, and medical applications where a bunch of electrons are required to be transported as a narrow beam.

Mid-Infrared Radiation from Semiconductor Plasmas Using Extraordinary Mode of Lasers: Laser

beat wave-induced mid-infrared (MIR) radiations are investigated in semiconductor plasmas under the application of transverse magnetic field. Beat envelope of two collinear laser beams interacts with the semiconductor plasma having density modulation in laser propagation direction. Nonlinear current generates at beat frequency (w=w1−w2) from the coupling of nonlinear velocity of charge carriers and modulated charge carrier density; it acts as source of MIR radiation. Here, Gaussian and flat-Gaussian field envelopes are created in extraordinary (X-mode) under the application of static magnetic field in the direction of laser magnetic field (Bs→||Bl→). Charge carrier density modulation is considered in the range of 10 to 30% of uniform carrier density and external magnetic field in the range of 0 to 0.5T in present numerical calculations. X-mode laser generates significantly enhanced MIR field in comparison to the ordinary laser mode. Also, flat-Gaussian pulses produce intense MIR radiations with twofold enhancement in the conversion efficiency.

Effect of Laser Intensity Redistribution on Terahertz Field Generation via Laser Wakefield in a Magnetized Plasma: The wakefield excitation in a plasma is very sensitive to the laser intensity distribution, which may further affect the plasma current generation. In this direction, we investigate the effect of laser intensity redistribution on wakefield-induced THz field generation in a magnetized plasma. Laser pulse induces wakefield by the charge separation in a plasma, having both the axial and transverse components. Axial component of wakefield accelerates the electrons and transverse field component propagates and radiates at plasma vacuum boundary. In this study different laser intensity profiles to excite laser wakefield and consequent terahertz fields have been considered. Field decentered parameter (b) is introduced in laser field profile that allows the redistribution of laser intensity. The intensity gradient force changes due to the effect of laser intensity redistribution that further affects the terahertz field significantly. The spectral analysis shows the terahertz field in the range of 19–20 THz and the peak value of the generated terahertz field is enhanced significantly for Hollow-Gaussian laser intensity distribution.

Terahertz Field Generation from Laser Interaction with Spherical Nano-Particles: Effect of External Magnetic Field: Present study investigates the THz field generation from laser beat wave interaction with spherical nanoparticles (NPs) in presence of external magnetic field. A cluster of electrons and ions is created during laser interaction with spherical NPs and surface plasmon oscillations. Oscillatory current produces at beat-wave frequency under the influence of laser imparted ponderomotive force. Oscillatory nonlinear current induces electromagnetic field in THz frequency range. Field decentred (FDC) parameter is introduced in laser field profile that redistributes the laser energy in space; external magnetic field is applied in transverse direction. THz field amplitude is estimated with respect to terahertz frequency under the variation of FDC parameter, Magnetic field strength and amplitude of the density perturbation. THz amplitude enhances significantly in presence of magnetic field with multiple resonance. It is found that the damping mechanism in plasmon oscillations of NPs can be controlled using laser intensity redistribution.

A.5.6 Dusty and Complex Plasmas

Non-Equilibrium "Triple Point" in Strongly Coupled Complex Plasmas: The first ever experimental observation of the co-existence of three phase states in a strongly coupled complex plasma medium have been made. This is indicative of the existence of a "triple point" in the system. Unlike the

traditional "triple point", as defined in equilibrium thermodynamics, the observed steady state co-existent states have different temperatures which may be manifestation of non-equilibrium effects in a driven dissipative system (Figure A.5.1).

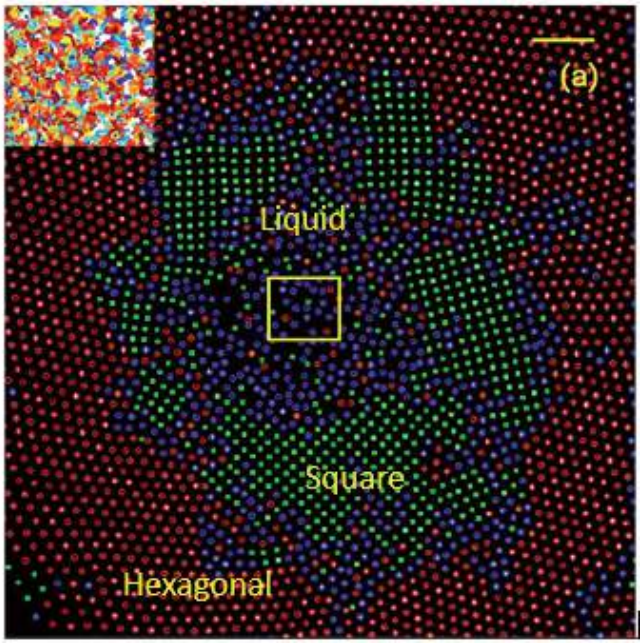


Figure A.5.1: Top view of camera image shows the existence of three states simultaneously. The inset figure shows the trajectory of the particles residing inside the yellow box for 2s.

Study of Plasma Sheath in the Presence of Dust Particles in a Magnetic Mirror-Like Field Configuration: The properties of a plasma sheath in the presence of dust grains and a magnetic mirror-like field configuration have been investigated. All the plasma species viz. electrons, ions, and dust grains are described by fluid equations which are solved by the Runge-Kutta fourth-order (RK4) method to explore the sheath properties. The results suggest that in the presence of a magnetic mirror-like field configuration, the component of ion velocity perpendicular to the wall decreases near the surface, and consequently, the ion density increases. This different observation is due to the magnetic field configuration alone. Such a behavior can be used to control the dynamics of the ions in the sheath. Moreover, ion-neutral collisions tend to reduce the effect of the magnetic field on the properties of the sheath. The study may be helpful to understand the interactions of plasma with the wall in different plasma assisted industrial applications containing dust grains as contaminants. Besides, the study will play a significant role in controlling the dynamics of positive ions and negatively charged dust grains in the sheath. The space charge shows an unusual behavior near the sheath. In the usual scenario, the space charge slightly decreases near the wall. But in the present context, the space charge increases. Further, it has been observed that the dust surface potential near the wall becomes less negative with the increase in magnetic field strength. The magnetic field and ion-neutral collisions tend to restrict the movement of the ions toward the wall when acting separately, but their combined effect leads to a different kind of behavior altogether.

Effect of External Magnetic Field and Dust Grains on the Properties of Ion-Acoustic Waves: An experimental study to investigate the effect of an external magnetic field on the propagation of ion-acoustic waves (IAWs) has been carried out in hydrogen plasma containing two-temperature electrons and dust grains. It is a first step in understanding the propagation properties of IAWs in such an environment. A low-pressure hot cathode discharge method is chosen for plasma production. The desired two-electron groups with distinct temperatures are achieved by inserting two magnetic cages with a cusp-shaped magnetic field of different surface field strengths in the same chamber. The dust grains are dropped into the plasma with the help of a dust dropper, which gain negative charges by interacting with the plasma. The IAWs are excited with the help of a mesh grid inserted into the plasma. A planar Langmuir probe is used

as a detector to detect the IAWs. The time-of-flight technique has been applied to measure the phase velocity of the IAWs. The results suggest that in the presence of a magnetic field, the phase velocity of IAWs increases, whereas introducing the dust particles leads to the lower phase velocity. The magnetic field is believed to have a significant effect on the wave damping. This study will aid in utilising IAWs as a diagnostic tool to estimate plasma parameters in the presence of an external magnetic field.

A.5.7 Fusion Technologies and Related Simulations

3D Computational Fluid Dynamics Analysis of PINI Ion Source Back Plate under High Heat Flux Condition: Neutral Beam Injection (NBI) plays an essential role in Tokamak plasma heating and current drive. A positive ion-based NBI (PNBI) system is adopted in Steady State Superconducting Tokamak- 1 (SST-1). This PNBI system is capable of generating neutral hydrogen beam power of 1.7 MW at 55 keV. This system has a JET PINI (Positive Ion Neutral Injector) type of ion source. The Back Plate (BP) is a component of the PINI ion source. It consists of an SS 304 L magnet positioning & cover plate, and an OFE copper cooling plate. The back plate plays a vital role in removing the high heat load intercepted during beam operation. The present study describes 3D Computational Fluid Dynamics (CFD) analysis of the actual size back plate using the ANSYS version of R121. The 3D CFD analysis has been done under a 2.5 MW/m^2 steady heat load incident on the OFE copper plate. Cooling water is provided in the Inlet header of the back plate with a mass flow rate of 1 kg/s at 34 °C. The analysis gives the surface temperature distribution over the OFE copper cooling plate with a maximum surface temperature of 174 °C and the average temperature is 122 °C. This result is in good agreement with high heat flux experimental results.

Analysis of the Coupling Characteristics of Ion Cyclotron Resonance Heating Antenna of Small Tokamak with the Help of 2D and 3D Antenna Codes: An analytical and numerical study of the coupling of strip-line antenna with small tokamak plasma is studied with the help of the ICRH antenna code SITAR (Simulation of ICRH anTennaA Resistance). The antenna is of finite poloidal and toroidal dimensions and screened from the plasma by a metal screen of anisotropic conductivity that shorts out the toroidal components of radio frequency electric field. A linear model of refractive index in plasma evanescent region has been considered to describe the propagation of wave in it. The plasma in the coupling region is described by cold plasma dielectric tensors with non-uniform density and toroidal magnetic field along the radial direction. Inclusion of finite antenna length, antenna lead currents as well as toroidal and poloidal variation of current in it (3D analysis) introduces an important difference in the antenna load resistance and inductance compared to those calculations when lead current is ignored and plasma is assumed to be invariant along the poloidal direction (2D analysis). The effect of plasma density, antenna length, wall and plasma edge distances on antenna load resistance and inductance has been studied using parameters of Aditya-U and SST-1 tokamaks.

A Staged Approach to Indian DEMO: A revised strategy for Indian DEMO in the context of new technologies and concepts in fusion research is presented. The central idea behind the new strategy is that the power plant is a reactor-park consisting of multiple, preferably compact, reactors with moderate fusion power (~1000 MW) with 35%–50% availability for each. The DEMO is a single net

electricity producing unit that becomes the basis for replication into multiple units on a commercial scale. One of the key enablers for the revised strategy is the emergence of high-temperature superconductors for high field magnets. For a steady-state burn it is shown that there exists an optimum regime of plasma β and confinement where the fusion gain is maximum. Thus, one adopts a strategy with moderate confinement regimes and plasma β. This makes current drive a necessity for the reactors. Based on these considerations a four-stage approach to DEMO is proposed. It is argued that an electricity producing pilot plant (PP) with fusion power of 200 MW–300 MW is needed before the DEMO to establish the power performance, tritium breeding and its re-use over sufficiently long pulses. An integrated test facility must precede the pilot to test and qualify the technologies for the pilot stage. The revised approach takes into account realistic assumptions on power balance, current drive efficiency and magnet lifetime-dose; factors that pose constraints in identifying potential reactor configurations. Parameter choices for possible options for the integrated test facility, PP and DEMO that can be used to initiate conceptual designs and directed R&D have been studied.

A.5.8 Material Studies

Neutronic Simulation of Medical Radioisotope ^{99}Mo and ^{177}Lu Production at 14 MeV Neutron Generator Facility: An accelerator based 14MeV neutron generator is commissioned at Institute for Plasma Research India. The generator is based on the linear accelerator concept where the deuterium ion beam impinged to the tritium target to produce neutrons. The generator is designed to produce 5×10^{12} n/s (max.). The 14MeV neutron source facilities are an emerging tool for the lab scale experiments and research. In order to utilize the generator for the welfare of humanity, the assessment is made for the production of medical radioisotopes using the neutron facility. The usage of radioisotopes in the treatment and diagnosis of a disease is an important factor in the healthcare sector. A series of calculations are conducted to generate radioisotopes, especially ^{99}Mo and ^{177}Lu those are having huge applications in the medical and pharmaceutical industries. ^{99}Mo can be also generated through neutron reactions ^{98}Mo(n, g) ^{99}Mo and ^{100}Mo(n, 2n) ^{99}Mo apart from fission reaction. The cross section of ^{98}Mo(n,g) ^{99}Mo is high in the thermal energy range whereas ^{100}Mo(n,2n) ^{99}Mo occurs at a high energy range. ^{177}Lu can be produced using the reactions ^{176}Lu (n, g) ^{177}Lu and ^{176}Yb (n, g)^{177}Yb. The cross section of both ^{177}Lu production routes is higher at thermal energy range. The neutron flux level near the target is around 10^{10} $cm^{-2}s^{-1}$. In order to enhance production capabilities, the neutron energy spectrum moderators are used to thermalize the neutrons. The materials used as a moderator are beryllium, HDPE, graphite, etc. Moderators enhance the capabilities of medical isotope production in neutron generators.

Simulation of Silicon Etching in NF_3 Plasma Reactor: The plasma etching process plays a vital role in microelectronics chip manufacturing and cleaning of the vapour deposition reactors. Plasma etching phenomena can be better understood using plasma-chemistry models. The interaction of gas species and surfaces species during plasma discharge creates volatile species which can come out from the surface very easily and contributes to the surface etch. The simulation of the etching process makes the plasma etching reactor superior by enhancing the performance and exploration of processes. The simulation of the silicon etching is carried out in an NF_3 plasma reactor. The plasma chemistry along with the surface chemistry models are utilized for reaction happening inside the reactor. Reactor parameters, such as pressure, RF power deposition,

mass flow rate, etc. were varied to enhance the reactor performance and understand the events' dependency. The simulation was done using the Perrin experimental parameters and simulated results were compared with the published experimental results. The simulation is based on the mixed plasma reactor within a certain volume. It does not account for geometrical parameters and therefore it is 0-d modelling of the reactor. The simulation is based on the flow dynamics along with gas and surface chemistry which shows the same trend as the experiment. The established simulation model has been used to estimate the etch rate in future experiments. The parameters and simulation results of a future - experiment are also included in the report.

Systematic Study of (p, n) and (p, 2n) Reactions on ^{110}Cd: Standard activation analysis technique with γray spectroscopy via off-line mode has been utilized for reaction cross section estimation. The proton beam was transported from the BARC-TIFR accelerator and targeted on the natCd target. The 16 MeV proton beam irradiated the sample, and Copper foil was utilized as an energy degrader. The activation cross sections were estimated for ^{110}Cd (p, n) reaction for the ground state ($J\pi=7^{+}$) population of ^{110}In nucleus and ^{110}Cd(p, 2n)^{109}In reaction at 14.14 MeV of proton energy. Along with experimental measurements, the theoretical study has been carried out for ground and metastable states population by utilizing the nuclear model code TALYS-1.95, EMPIRE-3.2.3, and ALICE-2014 for both reaction channels. The estimated cross sections are valuable for the improvement of theoretical nuclear model codes for a comprehensive knowledge of nuclear reaction mechanisms. The produced isotopes^{109,110}In have significant importance in Positron Emission Tomography (PET) studies. This study is a dive into the phenomenological and microscopic level density models of different nuclear model codes in predicting excitation functions.

A.5.9 Artificial Intelligence and Machine Learning

Heat Transfer and Fluid Flow Analysis of Pebble Bed and its Verification with Artificial Neural Net-Work: The advancement of sophisticated packed beds has significant implications for the development of new equipment for associated industries. The heat transfer and fluid flow properties of the functional material in the form of a pebble bed is crucial during the design phase of a solid-type ceramic breeding blanket in a fusion reactor. In order to efficiently construct and operate the breeder blanket, the goal of this study is to explore the features of heat transmission and fluid flow. Initially, the heat transfer and fluid flow analyses were carried out independently to benchmark the results using models and experiments using a stainless steel pebble bed with a diameter of 2 mm. Following that, a combined simulation analysis of heat transfer and fluid flow was carried out to demonstrate the systems effective operation for Li_2TiO_3. A model of an artificial neural network (ANN) has also been employed to forecast the results. The results of simulations are within 5% of the expected values made using ANN.

Development of DeepCXR-AI Tool: DeepCXR, an Artificial intelligence software, received patent (Indian Patent #451958) -technology developed inhouse by the institute, in collaboration with Indian Council of Medical Research (ICMR) Hd Qtr., Delhi and 20 other medical college/institutions across 10 different states within the country.
Recently, it has been approved by the high level Health technology assessment committee of Department of Health Research (DHR) - ICMR - MoHFW (Ministry of health & family Welfare), endorsing it as mature technology & suitable for wider adoption in India. It has also been recommended by ICMR to the MoHFW for use as a

screening tool under NTEP (National TB elimination program of India).

Institute is now coordinating with Central TB division of MoHFW for deploying DeepCXR as screening Tool. Documentation of required guidelines for all states of India to use DeepCXR (SOP) is in progress (Figure A.5.2a & b).

Figure A.5.2a). Abnormal CXR Image with fibrotic type region of abnormality identified.

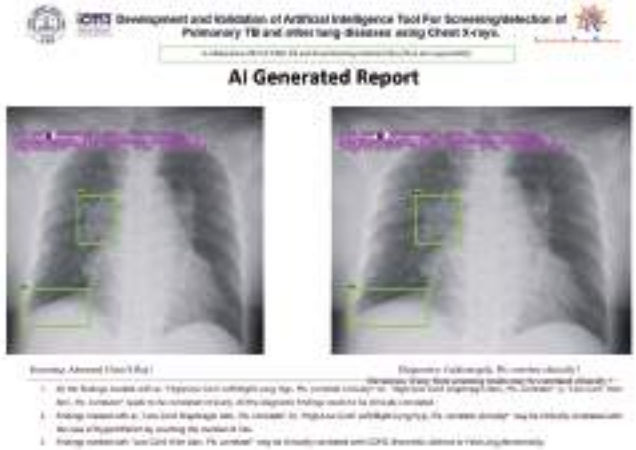


Figure A.5.2b). Abnormal CXR image with cardiomegaly type abnormality identified.

<u>*Deep Learning for Online CCTV Monitoring System in the Campus:*</u> An online CCTV monitoring system is developed & deployed in the institutes campus which utilizes AI technologies for robust and efficient surveillance by constantly overseeing more than 20 critical locations. This system takes parallel online streaming of data from the CCTV control room, and utilizes deep learning algorithms that is very well able to distinguish between the object and environment. The system is working 24 x 7 for last 3 months without any significant downtime. One such locations activities are shown in figure A.5.3 (a) & through a bar plot in figure A.5.3 (b), providing clear insights into the alert frequency on weekly basis. This system is designed to raise alarms immediately when a person or other designated object of interest is detected, ensuring prompt response to potential security breaches. The AI algorithms excel in identifying anomalies and unauthorized activities, significantly enhancing the monitoring process by enabling proactive security measures and minimizing false positives.

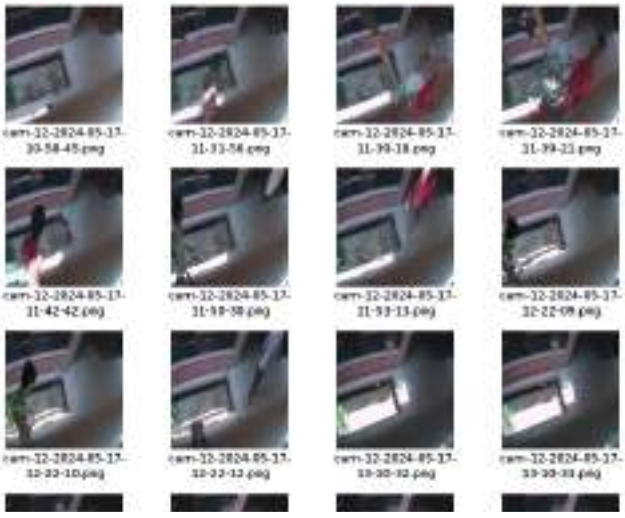


Figure A.5.3: (a). Visuals from one such location.

<u>*Deep Learning Assisted Microwave-Plasma Interaction Based Technique for Plasma Density Estimation:*</u> The study proposes a deep learning (DL) assisted microwave-plasma interaction-based non-invasive strategy, which can be used as a new alternative approach to address some of the challenges associated with existing plasma density measurement techniques. The electric field pat-

tern due to microwave scattering from plasma is utilized to estimate the density profile. The proof of concept is tested for a simulated training data set comprising a low-temperature, unmagnetized, collisional plasma. Different types of symmetric (Gaussian-shaped) and asymmetrical density profiles, in the range 10^{16}–10^{19} m^{-3}, addressing a range of experimental configurations have been considered in this study. Real-life experimental issues such as the presence of noise and the amount of measured data (dense vs sparse) have been taken into consideration while preparing the synthetic training data-sets. The DL-based technique has the capability to determine the electron density profile within the plasma. The performance of the proposed DL-based approach has been evaluated using three metrics-structural similarity index, root mean square logarithmic error, and mean absolute percentage error. The obtained results show promising performance in estimating the 2D radial profile of the density for the given linear plasma device and affirms the potential of the proposed machine learning-based approach in plasma diagnostics

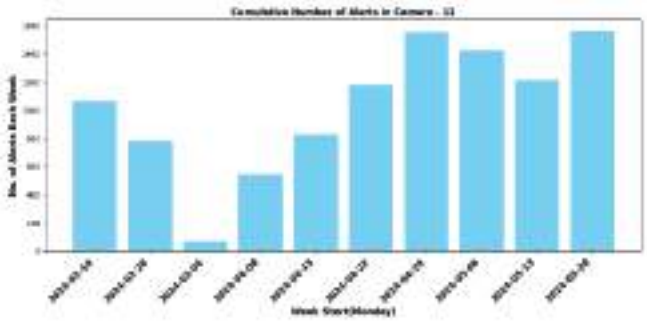


Figure A.5.3: (b). Number of alerts generated on weekly basis.

A6. Scientific, Technical & Civil Support

The following subsection briefs the activities and updates carried out by the scientific, technical and civil infrastructure support divisions to the institute's development, scientific and experimental programs. The details are highlighted below.

A.6.1 Scientific Information Resource Centre (SIRC)

Scientific Information Resource Centre (SIRC) is providing specialized Information Resources and Publication Management services using up-to-date tools to the scientific community involved in the Research and Development activities of Plasma Physics and Fusion Science and Technology.

During the year 2023-24 a total budget of Rs. 33945702.00 was utilized and added the following to its collection:
139 Scientific and Technical Books were added to the collection, 87 Books were procured through a Books Exhibition organized at the Institute on 24th January 2024, 13 Hindi books, 176 Reprints, and 31 Pamphlets were also added to the library collection.

Institute has signed a Transformative Agreement with IOPP, UK. The Read & Publish agreement allows access to the entire IOP Journals collection and also Publishing in IOP's fully Open Access journals. Institute is also a part of the DAE's Transformative Agreements with publishers viz. Springer-Nature and Wiley under One DAE One Subscription (ODOS) consortium. Library has also subscribed to 60 periodicals and added 1 new online journal title as well as 2 journal archives to the e-collection and continued to subscribe to major databases such as SCOPUS, APS-ALL, Online Archives of core journals.

Library through its Digital Display Board provides interactive and up-to-date Current Awareness Services. Library is also delivering email-based FYI-Fusion News Alerts services to IPR, CPP and ITER-India users. Total 360 News items were sent/displayed and archived as an Alerting Service.
Library continued to collaborate with DAE units and other National and International libraries to provide Inter-Library Loan (ILL) services. 90.75% of the requests made by staff members were satisfied through ILL service. IPR Library provided documents to other institutes against their queries and 100% of the total need were satisfied.

In 2023-24, Library provided 25797 photocopies/prints and 6409 scanned copies to the users.

Publication Management Services were carried out efficiently and SIRC continued to subscribe to anti-plagiarism software tool for checking similarity index of the publications. A total of 661 manuscripts (Abstract/Papers) and 05 Patent information were

broadcasted to the Staff through the Pre-Publication Broadcasting System and Pre-Patent Broadcasting System respectively on the Intranet portal. A new feature for Conference and Awards information submission has been developed and implemented on the INTRA portal.

SIRC published the following during the year 2023-24: Internal Technical Reports – 68; Internal Research Reports – 124; Institute's Publications in Journals – 176; Institute's Publications in Conference Proceedings – 22; Book Chapters – 5.

Hands-on Training was imparted to the three Multi-Tasking Staff deputed at the Library. Library Internship was provided to Four library science students from Gujarat University, Ahmedabad. Orientation was given to newly joined members, Research Scholars and SSP students. Library is actively participating and contributing to other Institutional activities, such as Swacchata Pakhwada, Safety Week, National Science Day, etc. Library is also actively involved in OLIC and promoting usage of Hindi language.

A.6.2 Mechanical Engineering Services Division (MESD)

MES division has four sections namely Engineering Design & Analysis Section (EDAS), Inspection & Quality Section (IQS), Drafting Section and Workshop Section. The activities undertaken by the division is conforming to full product cycle which includes concept to commissioning. The major tasks are design and analysis of the product/system, preparation of the engineering drawings, fabrication/manufacturing and inspection, testing and commissioning. The division is also supporting the inspection of incoming stock items at Store. The division comprises of team of Mechanical Engineers, draftsman and technicians. MESD division has provided the services to different divisions such as SST-1, Aditya, Magnet, Cryogenic, Neutronics, Remote handling, NBI, Fusion Blanket, Cryopump, Fundamental Physics etc. MESD also provided the extensive services to FCIPT also.
The EDAS of MESD has been actively executing various tasks related to design, analysis, fabrication, inspection and testing. Since its inception in April 2017, section has satisfactorily completed and report is submitted for more than 170 tasks for different divisions. The design is carried out using ASME, WRC codes, vacuum protocol etc. The FEM analysis is performed to ensure the structural integrity of the system/product. The different kind of analysis such as structural, thermal and coupled is being carried out routinely using ANSYS.
The IQS of MESD has been actively executing various tasks related to Welding Procedure Specification, Manufacturing and Inspection Plan, Material testing, Quality Assurance, Quality Control, Different kinds of Non-Destructing testing etc. The activity related to assembly, disassembly, interference checking, new components assembly etc. of the different components for SST-1 are also supported by this section. During the year, IQS division also completed more than 20 tasks.

The Drafting section of MESD is equipped with 6 licences of CATIA-V5 R13 installed on work stations for 3D modelling and 2D drawing preparation, HP inkjet printer T2300 plotter. Section has been supporting the users for designing and preparation of engineering drawings for various systems of the institute. During the year, section has executed more than 600 job cards for 3D modelling and 2D engineering drawing preparations. Section is also supporting the poster printing for different conferences and presentations.
The Workshop section of MESD is equipped with modern versatile machineries including machining and fabrication (shearing, rolling, TIG welding etc.)

facilities catering for needs of the institute, FCIPT, ITER-India and CPP for the fabrication of a system/product required by users. Workshop has the 3-axis abrasive water-jet machining facility useful for machining the intricate shapes of different materials at room temperature. It has also CNC and VMC machining centre. Workshop is also manufacturing vacuum components which are used as stores stock items. During the year, workshop has executed more than 1100 job cards (including 400 job cards of abrasive water jet machining) and fabricated systems/product of different materials (Stainless steel, Aluminium, Copper, Brass, Ceramics, Teflon, Hylum, PEEK etc.) weighing more than 9500 kgs.

A.6.3 Air Handling Unit and Air Conditioning Services

15 MW Cooling Water System: Installation activities related to a Cooling Water System (CWS) with 15 MW heat rejection capacity are underway and will be used to reject the heat generated by various experimental set-ups installed inside ITER-India and institute's laboratories.

Figure A.6.1: Ongoing installation activities.

The delivery incudes FRP Cooling tower with heat rejection capacity 15 MW, water cooled screw chillers 300 TR capacity (2 nos.), 20 centrifugal pump sets, 5 plate type heat exchanger. with maximum capacity up to 9 MW. Most of the equipment have been installed and major part of piping erection has been completed as shown in figure A.6.1. In order to provide ultra-pure water with ionic conductivity $\leq$ 0.1µS/cm and dissolved oxygen limit of $\leq$ 0.01 ppm to the above CWS, a contract for the supply of water polishing system has been awarded and the detailed design has been completed.

Water Cooling and Air Conditioning: Replacement of Old Packaged AC System with New DX Type Air conditioning System at Data Center E-class room: Supply, Installation, testing and commissioning of DX type air-conditioning system with VFD based Air handling unit (14 TR, 4800 CFM). This system consist of Duct mounted heater for RH control and having PLC based controller for temperature and RH control. This is a replacement of old packaged type air conditioning system (Figure A.6.2).

Figure A.6.2: Replacement of old fixed speed split ACs with new inverter type split air conditioners (5 Star) in various rooms of institute's guest house.

Supply, Installation, testing and commissioning of energy efficient inverter type split air conditioners (02 TR X 12 nos., 1.5 TR X 04 nos.) with 5 star rating. This is replacement of old fixed speed split air conditioners in the guest house rooms.

Design, supply, Installation, testing and commissioning of cabinet type air exhaust system with ducting, grills with VCD and non-vision grills. The capacity is 900 CFM and connected to Gents toilet, handicapped toilet and ladies toilet through ducts and grills. Non vision type fresh air grills are installed on each door of toilets.

A.6.4 Civil Infrastructure

Inauguration of New Lab Building at FCIPT: Construction of new shed building (~460 Sqm.) at FCIPT Campus in Gandhinagar has been completed and handed over to the user. Construction of additional infrastructure in institute's campus during the year includes - Construction of Shed building at FCIPT campus, STP – Tender process is completed, work order has been placed and the work is near completion. Reception and Stores shed Building – Tender process is completed and the execution of the work order is under process.

Among other minor works, Institute has completed following Civil Construction works: Pathway to access shed for Electromagnetic Laboratory (EML), Construction of Additional washroom block at Guest House, Increase in Height of Boundary wall & laying of Concertina Coil Fencing, At FCIPT campus, construction of Watch towers, concertina coil fencing and internal pathway along entire boundary wall.

Institute is developing a common biomedical waste treatment facility (CBWTF) of 5 Tons per day capacity for safe disposal of biomedical waste. This plasma pyrolysis system will be installed & commissioned at Varanasi, Uttar Pradesh. However, this system will first be assembled & tested - using simulated medical waste at FCIPT. After successful testing, it will be shifted to Varanasi. A new lab building is constructed for housing and testing of this facility at FCIPT campus. Another facility of Plasma nitriding for industrial components which would be jointly operated with Industries on a GOCO (Government Owned Contractor Operated) model, will also be housed in this new lab building. Further, this space will also be used for establishing a high capacity gasifier using an indigenously designed & developed plasma torch system of 320 kW capacity. This new lab building was inaugurated by Dr. Shashank Chaturvedi, Institute's Director on 05th of January 2024 (Figure A.6.3).

Figure A.6.3: Ribbon cutting ceremony by Dr. Shashank Chaturvedi, Director IPR.

Renovation and Up-gradation Works: Many civil renovation works have been completed, major among them include the following:

1. FCIPT campus:

Re-painting of old rolling shutters at different buildings, renovating washrooms tiles and repainting canteen building, construction & modification of aluminum partition, ceiling and associated works, construction of approach pathway and foundation for porta cabins.

2. Institute campus:

Renovation of existing workshop building, old washroom renovation, re-painting of offices, guest house reception area, and other associated works, raising of paved parking area and other associated work, replacement of wall tiles and associated

work of additional building washrooms, miscellaneous civil work in library including sound proof partition, renovation of CRAY hardware room to convert it into meeting room, miscellaneous civil renovation works at various laboratories to upgrade existing infrastructure, replacing of Fly proof mesh old windows and Fly proof Aluminum door works at back side balcony of hostel rooms.

A7. Patents & Technology Transfer

The following subsection briefs on the patents granted and filed by the institute.

A.7. Patents & Technology Transfer

A.7.1 Patents Granted

1. A Wideband Hybrid High Power MW Level CW Radio Frequency (RF) Combiner / Splitter -Akhil Jha, P. Ajesh, J.V.S. Harikrishna, Rohit Anand, Paresh Vasava, Manojkumar Patel, R. G. Trivedi and Aparajita Mukherjee, Patent No. 426278 (Indian App. No. 201821011151 dated 26-Mar-2018).
2. MW Level CW Single Pole Double Throw (SPDT) Coaxial Radio Frequency (RF) Switch - P. Ajesh, Akhil Jha, Rohit Anand, Paresh Vasava, Hrushikesh Dalicha, Hriday Patel, Kumar Rajnish, R G Trivedi, Aprajita Mukherjee, Patent No. 426292 (Indian App. No. 201821011443 dated 27-Mar-2018).
3. An Apparatus for Water Treatment to Activate Water Using Atmospheric Pressure Hybrid Plasma System, Sudhir Kumar Nema, Vishal Jain, Adam Sanghariat, Subroto Mukherjee, Nirav Jamnapara - Patent No. 460455 (Indian App. No. 201621043562 dated 20-Dec-2016).
4. A Method for increasing the life of Cutting Tools, Alphonsa Joseph, Ghanshyam Jhala, Akshay Vaid, and Subroto Mukherjee – Indian Patent No. 488119 on Dec. 25, 2023,(App. No. 201821022517 dated 15-Jun-2018) – IPR.
5. Atmospheric pressure plasma jet for biomedical applications, Akshay Vaid, Patil Chirayu, Adam Sanghariat, Ramakrishna Rane, Abhijit Majumdar, Subroto Mukherjee - Indian Patent No. 497593 dated Jan 11 2024 (Application No. 3727/MUM/2015).
6. A method for the realization of dense isotropic h-boron nitride and its silica composite', Remyamol Thekkayil (VSSC), Mappillatharayil Raman Ajith (VSSC), Mukesh Ranjan (IPR), has been Granted by Indian Patent Office. The patent number is 504606 on 31 Jan 2024 (jointly to VSSC and IPR).

A.7.2 Patents Filed

1. A Rapid, Low-Cost Process for the Preparation of Surface Enhanced Raman Spectroscopy (SERS) Substrate and SERS Substrate Prepared Thereby, M. Ranjan, S. Augustine, K P Sooraj, M. Saini, S. Hans, V. Pachchhigar, B. K. Parida - Indian App. No. 202321081756 dated 01-Dec-2023 – IPR
2. A Plasma based System for Generating

Antibacterial Coating on Flexible Polymeric Substrates and Process Thereof, R Rane, A. Vaid, J. Alphonsa, N. Jamnapara - US App. No. 18/450,956 dated 16-Aug-2023 (based on Indian App. No. 202321003767 dated 19-Jan-2023) – IPR

3. Provisional Indian patent filed: System and method for Air disinfection, A. Joseph, R. Rane, A. Vaid, A. Visani- Provisional Indian patent application 202341063140 dated 20 September 2023 co-jointly by IPR and CCAMP.

Transfer of Know-how and Licensing of Plasma Pyrolysis Technology for Safe Disposal of Biomedical Waste: Institute has successfully transferred the know-how of plasma pyrolysis technology (RAUDRATM) for safe disposal of biomedical waste on non-exclusive basis to M/s Bhakti Energy, Rajkot on July 10, 2023. This know-how transfer and licensing enables the agency to do marketing and deploy plasma pyrolysis systems (RAUDRATM) as per the need of end users across India (Figure A.7.1).

Figure A.7.1: Execution of technology transfer agreement and know-how transfer by the institute to M/s Bhakti Energy.

Transfer of Know-how of Glow Discharge System Along with Langmuir Probe Diagnostic: A know-how to make DC glow discharge system along with Langmuir probe diagnostics is transferred to M/s Sun vacuum & Plasma engineering, Ahmedabad (Figure A.7.2). With this system the students can learn low pressure plasma production using DC power and plasma diagnostic using Langmuir probe. The experiments like Paschen curve, Plasma Striations, DC glow discharge regions, measurements of Plasma density and electron temperature etc. can be performed using this system.

Figure A.7.2: Execution of technology transfer agreement and know-how transfer to M/s Sun vacuum & Plasma engineering, Ahmedabad.

CHAPTER B

INTERNATIONAL COLLABORATIONS

B. International Collaborations

The institute is also actively participating and contributing to the following major international mega science experimental collaborations like ITER and Laser Interferometry Gravitational-wave Observatory (LIGO) setup as equal partner in designing, fabricating, testing and supplying various systems and subsystems. The major milistones achieved are detailed below.

B.1 Activities of ITER - India

ITER continues its quest towards building of the world's largest TOKAMAK to demonstrate the scientific & technical feasibility of its use in fusion power plants of future. Steady progress includes the completion of manufacturing of all the PF coils, commissioning activities of the world's largest cryogenic plant, completion of building for housing the power supplies for neutral beam systems, initiating activities for establishing a test bed for performing cold tests on the PF and TF coils and repair of some of the important components viz. the thermal shields and the vacuum vessel sectors. In addition, work continues on a revised baseline to control further delays of the construction phase, make the experimental phase of ITER more effective and to demonstrate Q=10 in a low neutron phase while replacing Be with Tungsten as the first wall material. Such a step will allow for a hands-on approach towards repair needs arising out of initial operations of such a first of kind machine while moving steadily towards demonstration of ITER goals. Adjustments in the auxiliary heating mechanisms are under consideration which include EC upgrades to 67 MW in 2 operational phases. Efforts are also underway at ITER to engage different experimental facilities around the world to mitigate the issues envisaged due to changes in the first wall material from Beryllium to Tungsten.

ITER India continues its steady progress towards fulfilling Indian commitments to ITER. These include progress on the assembly of the Torus Cryopump Housing System (TCPH) nearing completion, delivery of 3 out of 5 Auxiliary Cold Boxes (ACB) and progress of installation of the X and Y cryolines at ITER site. The Diagnostic Neutral Beam (DNB) Beam Line Components (BLC) also arrived in ITER India laboratory from the factory. Several other successes in R&D activities are also described below.
The following are the updates on In-Kind contributions to ITER project.

Cryostat and Torus Cryo-Pump Housing (TCPH):
The ITER cryostat (Figure B.1.1) is a large high-vacuum chamber (16,000 m^3, ~30 metres wide and tall, weighing 3,850 tonnes). The cryostat helps to maintain, ultra-cool environment for the superconducting magnets of ITER. The Torus Cryo-Pump Housing (TCPH, Figure B.1.2) assembly is a pen-

etration located on the Cryostat cylinder with main functions to accommodate and support the Torus Cryo-Pump (TCP), connect it to the Vacuum Vessel and also provide the confinement.

Figure B.1.1: Cryostat 3D view.

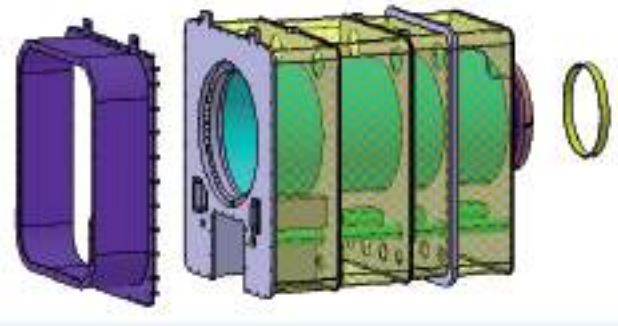


Figure B.1.2: TCPH assembly.

Manufacturing of all six TCPH and the assembly with bellows have been completed and Factory Acceptance Test (FAT) is ongoing as shown in figure B.1.3.

Further, the instrumentation system for Cryostat was also largely completed. All seven Signal conditioning Cubicles (SCC) along with the Optical Sensors for displacement and acceleration measurement have been delivered at ITER Site after testing at the factory. Figure B.1.4 shows the SCCs at ITER site. These SCCs shall be installed in the Tokamak Building (B-11).

Figure B.1.3: Manufacturing of all TCPH assembly completed at factory.

Figure B.1.4: I&C Cubicles delivered at ITER site.

<u>*Cooling Water System:*</u> The integrated commissioning of three water-cooled chillers of 4 MW capacity supplied by India has been completed successfully with necessary support from ITER-India. Figure B.1.5 shows the chillers installed at ITER site. The technical specifications and qualifying requirements of ITER safety valves, to be supplied by India have been finalized and the manufacturer of such valves has been shortlisted.

As part of separate agreement with ITER, ITER-India supported the final design of CHWS-H1A, CHWS-H1B and CHWS-H3 by carrying out process design, hydraulic analysis, seismic analysis of

pumps, pressurizers and chillers. In another task, ITER was supported in the integrated system testing, commissioning, preparation of engineering work packages, etc. ITER-India also assisted ITER in the procurement of spares from the original Indian manufacturers.

Figure B.1.5: Water cooled chillers.

In-wall Shielding Blocks: In wall shielding blocks are embedded in the walls of the Vacuum Vessel of ITER to provide shielding against the fast neutrons generated by fusion eraction. The complete scope of the in-wall shielding blocks as agreed in the Procurement Arrangement (PA) has been completed by India and the full amount of associated credits has been released by ITER organization.

Cryo-distribution and Cryolines System: The ITER Cryo-Distribution (CD) system distributes liquid Helium at 4K at required flow rate to the superconducting magnets and cryopumps via five ACBs (Auxiliary Cold Boxes), one CTCB, and one Thermal-shield Cold Valve Box. Schematic of a typical ACB is shown in figure B.1.6. Three out of five Auxiliary Cold Boxes (ACBs) (with an overall dimension of 5.6 m length, 5 m width and 4.8 m height) of ITER Cryo-distribution system have been delivered at ITER site after successful testing at the factory. Currently, they are positioned temporarily at the L3 level of the B11 building as shown in figure B.1.7.

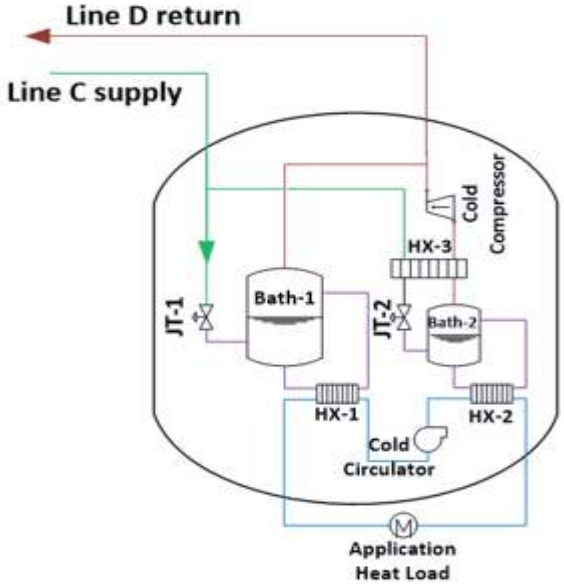


Figure B.1.6: Schematic of a typical ACB.

Figure B.1.7: ACBs in B11-L3 temporary position.

The FAT of ACB warm panel has been completed. The purge and guard panels for the ACBs have been successfully tested at the factory and delivered at the ITER site. The manufacturing of the Thermal Shield Cooling System is currently in progress.

Further, site installation of Group X cryolines, has progressed to ~63%. In addition, work on the installation of the warmlines has started on cryo-bridge connecting the Tokamak building to the Cryo-plant building. The site activities of Group Y cryolines and warmlines are presently on-going at L3 level of Tokamak building. The global percentage of completion for Group Y cryolines and warmlines is ~78%. Figure B.1.8 & B.1.9 shows installed cryolines at ITER site.

Figure B.1.8: First delivery from INOX in cryo-bridge.

Figure B.1.9: Installation of warmlines and Group-X cryolines on cryo-bridge.

<u>Diagnostic Neutral Beam (DNB) System:</u> Works towards testing the DNB system in ITER-India laboratory have made significant progress. The beam line components, viz the neutralizer, the electrostatic residual ion dump and the V shaped calorimeter with openable arms, have been delivered at ITER-India test facility after successful tests at factory. The site acceptance tests are scheduled. The manufacturing and assembly of the ion source components is also progressing towards completion, the assembly checks on the grid assembly is underway as shown in figure B.1.10 to establish best aperture alignment of the multi-aperture grid system.

Figure B.1.10: Plasma box assembly for the 8 driver RF negative ion source.

Moreover, the contract to start manufacturing of the DNB Vacuum Vessel has been placed for both the DNB vessel and the HNB3 vessel obtained through a task agreement.

<u>Ion Cyclotron Resonance Frequency (ICRF) Heating Sources:</u> 20 MW of ICRF power sources are another commitment from India to ITER. As part of indigenization, the manufacturing and final assembly of high-power RF cavity parts and associated components of the High-Power RF Amplifier (HPA-2) has been completed. The HPA-2 assembly has been integrated with the 10-kW solid state power amplifier (SSPA), high voltage power supply, auxiliary power supplies, water & air-cooling connections, control and interlock circuits as shown in figure B.1.11. In addition, position setting of tuning motors as per operating frequency has been determined. The performance test of HPA-2

been initiated and tuning is completed in the entire frequency range. High-power test (120kW/2000s) is also initiated for 36 & 40MHz. Figure B.1.12 shows the typical experimental results at 40MHz.

Figure B.1.11: Integrated 120kW HPA-2 with test setup.

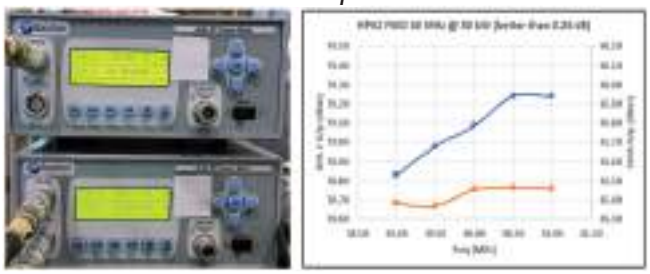


Figure B.1.12: Output power 120kW at 40MHz with drive power of 5kW and ± 1MHz bandwidth.

Figure B.1.13: Assembled 3 MW mismatch transmission line.

Further as part of indigenous development, 12-inch 3 MW mismatch Transmission line [MMTL] system has been successfully developed and integrated on the test bed, figure B.1.13, to test 3MW RF source for match and mismatch load conditions with minimum changeover time. This shall be followed with low and High-power RF tests in the next phase.

In addition, Signal Conditioning Modules (SCMs) for the Local Control Unit of IC RF source have been successfully developed indigenously. The SCMs are at present under CE certification process at TUV lab, Bengaluru. EMI/EMC (IEC 61000-6-2 and IEC 61000-6-4) and Environmental testing (Vibration test, Dry heat cyclic test, Damp heat test, Mechanical shock test) along with safety test (IEC 62368-1) is completed successfully (Figure B.1.14).

Figure B.1.14: Signal conditioning modules under CE certification at TUV lab.

The indigenously developed Solid State Power Amplifier (SSPA) for 10kW/36-60MHz have been tested for 5kW in the entire frequency range of 36-60MHz, Figure B.1.15. Presently, integrated test with final power combiner is under progress with an aim to demonstrate the performance for the rated parameters.

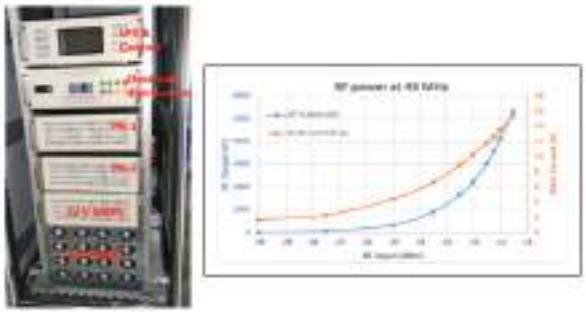


Figure B.1.15: View of SSPA with PA modules and test results.

Electron Cyclotron Resonance Heating (ECRH) System: After successfully completing the Gyrotron site acceptance tests (170 GHz, 1MW, 1000 s) (Figure B.1.16) and commissioning of MW class Gyrotron test facility, several mandatory upgradations and improvements across various auxiliary systems of the test facility (such as the power supplies, control system, cooling system, and other infrastructural items, etc.) have been undertaken to enhance the system performance and reliability.

Figure B.1.16: Gyrotron set up at ITER-India Gyrotron test facility.

The operational campaign aimed at gaining operational expertise, has been concluded successfully wherein the targeted performance of 500 kW of output RF power with a pulse length of 10s has been achieved, figure B.1.17 shows the test results. Infrared image burn pattern is shown in figure B.1.18.

The implementation of further improvements identified during the operation is ongoing. Further, the design activities of the Cooling manifold and Control system towards ITER Final Design Review (FDR) have been initiated under ITER PA activity.

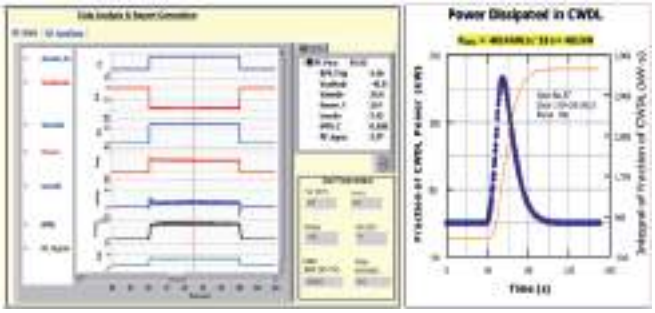


Figure B.1.17: Phase-1 (500kW, 10s) operation test graphs (Key electrical and calorimetric parameters.

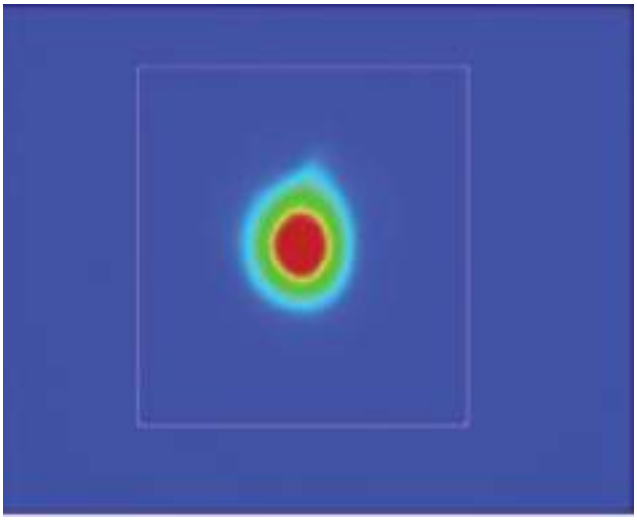


Figure B.1.18: IR image of the beam burn patterns.

Multi Megawatt Power Supply Systems:

Figure B.1.19: a) Integrated operation of 25kV body power supply, b) thyristor stack development & c) prototype of 3kW HFIM modules for 200kW RFG.

An indigenously developed 25 kV, 100 mA PSM-based Body Power Supply (BPS) has been developed for Electron Cyclotron Resonance Heating (ECRH) systems (Figure B.1.19). This advanced power supply operates in both pulse and Continuous Wave (CW) modes. Housed within a 0.8 m x 1.5 m x 2 m cubicle, the BPS comprises a multi-secondary transformer, 72 switched power supply modules, a controller, and measuring/protection units. Leveraging PSM technology and a modular design, this power supply enhances reliability and minimizes downtime. It offers precise control over a voltage range of 10-25 kV with an accuracy and repeatability of +/- 1.25%. Additionally, it provides programmable rise/fall times (1-5 ms) and voltage modulation capabilities from 0 to 100% of the set voltage. The BPS has successfully undergone testing up to 25 kV for a duration of 1 second. It is envisaged to integrate BPS with a 42 GHz Gyrotron for Aditya-U experiments, figure B.1.19a.

Development of a 5kA, 500V Thyristor stack (3-phase full bridge) has been accomplished successfully. The stack is installed at ITER-India lab and is being performance tested. Figure B.1.19b. This activity aims to develop modular approach for very high current (say, above 50kA), four quadrant converters for magnet systems

The 7.2MW, 100kV AGPS supplied by ITER-India has successfully completed 4 years of integrated operation on SPIDER experiments at NBTF, RFX Padua, Italy site with remote & onsite support from ITER-India.

Apart from the above, integrated operation of MW HVPS with Klystron of LHCD system has been successfully carried out for required power with time synchronization and load protection in a remote mode. The 3MW HVPS is being continuously utilized for validation, initial operation of integrated IC RF source at SST-1 and Aditya-U.

An upscale version of 200kW SSRFG (1MHz), based on previous prototype 40KW system is being developed under contract with M/s. ECIL. Following the design approval manufacturing of DCPS and High frequency Inverter modules have started at Vendor's site, figure B.1.19c.

<u>*Diagnostics:*</u> The preliminary design review (PDR) of two diagnostics systems (ECE, XRCS-Survey) has been completed. In parallel, development have continued on several diagnostics to be supplied to ITER. These include systems for XRCS-Survey diagnostic, XRCS-Edge diagnostic, CXRS pedestal diagnostic system and the ECE diagnostic system. A high transmission fibre bundle assembly with bundle-to-bundle coupling (36 fibre in one connector complying ITER requirement) has been developed, tested and characterized and figure B.1.20 shows the fibre bundle assembly.

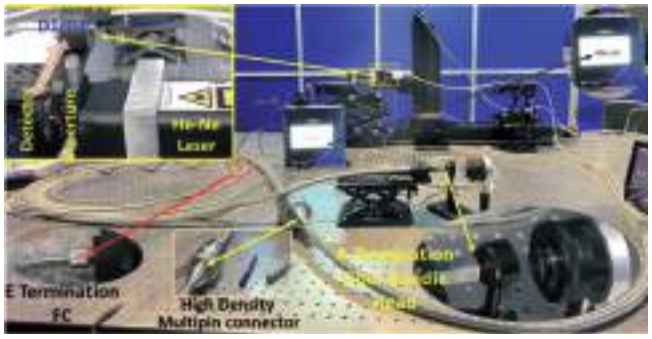


Figure B.1.20: ITER-India lab testing of the fiber bundle assembly for the CXRS pedestal diagnostic.

The front part of the sight-tube of XRCS Survey has been manufactured (Figure B.1.21) with ITER grade stainless steel material. This safety important class-1 component will be welded with the closure plate at the equatorial port (EP-17) integration site in Russia.

Figure B.1.21: The manufactured front part of the vacuum extension of XRCS survey diagnostic.

Prototype development of a large area vacuum compatible hybrid pixel photon counting detector, HPPCD, for XRCS diagnostics systems has been completed and tested for its performance (Figure B.1.22).

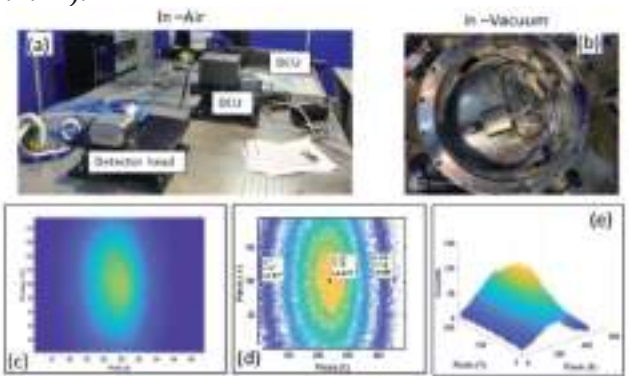


Figure B.1.22: Prototype development of a vacuum compatible HPPCD for XRCS diagnostics systems. (a) In air operation of the PILATUS-3 detector, (b) DU: Detector Electronics Unit, (c) Image of X-ray source (Co-57) on the detector, Energy: 6.4 keV & 7.1 keV, (d) 2D mapping of source onto detector, € Intensity distribution.

Further, a large area high-temperature black body source in millimetre wave region has been developed at ITER-India (Figure B.1.23). It is intended to be used for local calibration and performance testing of prototype sub-systems and components of ITER ECE Diagnostics system.

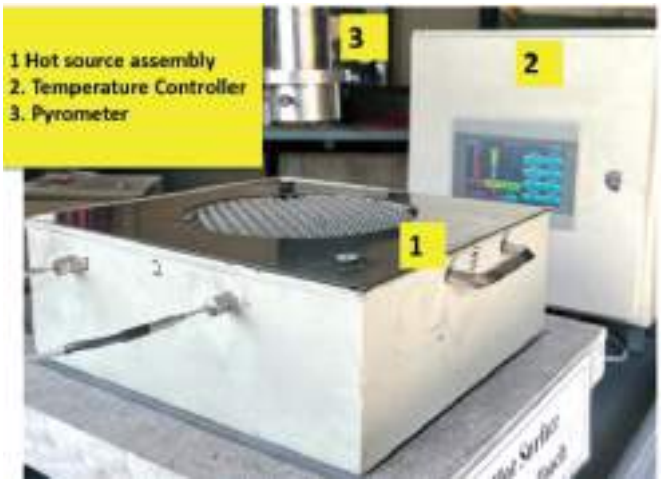


Figure B.1.23: Fabricated hot source with temperature controller system.

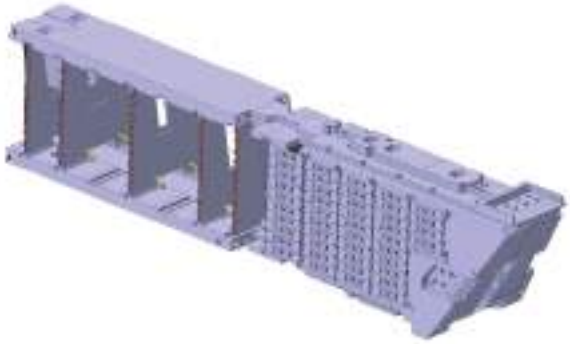


Figure B.1.24: Customized DSM with Shielding optimization.

<u>Upper Port:</u> One of the upper ports to support port plug assembly, the interspace assembly and the port cell assembly is to be supplied by India to ITER.

The design development of in-vessel components including Diagnostic Shielding Modules (DSM), port plug structure and their integration is currently ongoing. Customized design of DSM to meet the tenant diagnostics requirements has been developed, CAD model (Figure B.1.24) has been prepared and is currently being analyzed for neutronics load. Preliminary CFD analysis has been performed to check the cooling layout.

Technical Engagements Other than in-kind Contributions: Apart from activities towards delivery of in-kind contribution, ITER-India staff are also engaged in various technical and managerial groups working in diverse areas of ITER. Some Indian members are participating in Task Forces formed to find resolutions of technical issues mentioned above, others are also contributing to the efforts towards revision of scientific and technical baselines. ITER follows a consultative approach to major issues and Indian participation is actively pursued, this is a continuous process.

In addition, ITER India has signed few Task Agreements with IO (fully funded by IO). These include manufacturing of Heating Neutral Beam vessel, is under progress, and the development of prototype rupture disk and catalyst for hydrogen mitigation system the activities related to which have been initiated.

Modelling Activities: The OOPS code has been updated (0D ECR power absorption model and self-consistent dynamic evolution of impurity charge states are included). Implementation of OOPS code on the IMAS platform is under discussion with ITER. Linear and nonlinear simulation of the conventional and short scale ITGs for ADITYA-U have been carried out using global gyrokinetic PIC code ORB5. Effects of Magnetic Equilibrium Shaping on the linear and nonlinear ITG/SWITG/TEM modes have been performed using ORB5.

Activities of the Knowledge Management Group: The Knowledge Management group, has been studying and archiving technical documentation of ITER System systematically in INDUS documentation system of ITER-India. These documents cover PA Documents, Base line documents (DDD, SRD etc.), Design reviews (CDR, PDR, FDR, MRR), Prototype, Manufacturing, Safety, ICDs and Interface Sheets, Assembly, Deviation Requests, Project change request, Project management, publications etc. This group primarily focus on ITER System ranging from Vacuum Vessel, Magnets and their power supplies, Blanket system, Divertor system, Remote handling, Thermal Shield to Tokamak complex building. A total of ~5000 technical document has been archived so far.

HR Development and Collaborations: As a part of HR development, 3 institute's PhD students worked at ITER for 6 months on specific physics problems which were an extension of the problem being pursued towards fulfilment of their degree programs. The extension problems were designed in consultation with specific mentors in the ITER Physics group and are of interest to ITER as well. The students have completed 70-80% work on these problems during their stay at ITER which has not only involved learning of specific codes but also development and benchmarking of additional codes relevant to such problems and the physics aspects. The learnings, findings, experiences are being compiled in the form of a report.
Additional young scientists and engineers from ITER India and the institute are also collaborating with their counterparts at RFX, Neutral beam test Facility (NBTF) in Padua. NBTF has two test beds, the SPIDER test bed for 100 kV H- beams and MITICA for producing and characterizing 870 keV H and 1 MeV D negative and neutral beams.

B.2 Laser Interferometry Gravitational Wave Observatory (LIGO - India)

Activities Towards Development of Vacuum and Mechanical Systems: One more out-gassing measurement system with few upgrades is setup this year in LIGO laboratory at the institute. The major vacuum components of this facility have been procured and facility is setup which is now ready for its operation (Figure B.2.1). This outgassing system is helium leak tested to $1x10^{-10}$ mbar.l/s. The gate valves procured for this system have been integrated and tested successfully. Complete outgassing system is currently undergoing vacuum baking to 150°C to improve on its vacuum performance. Trial of inserting ~150 number of coupons from different ports available on the outgassing system was carried out to understand the complexity and the limitations involved. The complete system with 150 coupons inside was also evacuated to 10^{-8} mbar range at the initial stage.

During the period of consideration in this report to set up LIGO-India – Vacuum Integrated System Test Assembly (LI-VISTA) LIGO India division managed two procurement contracts related to 20 m vacuum vessel and the 80K Cryopump both along with vacuum equipment and control display unit (Figure B.2.1).

The 20 m vacuum vessel has been delivered, assembled and integrated with vacuum equipment & control display unit. The integrated vacuum vessel testing has also been completed during which operation of all equipment, operation data logging and output of vacuum gauges were monitored through a control unit. Helium leak testing, baking to 1500° C and soaking for desired duration is performed prior to demonstration of vacuum as per specifications.

The fabrication of 80k Cryopump vacuum vessel and testing at factory has also been completed. The system has been delivered at institute's site and its installation and integration of vacuum equipment is in progress.

Subsequently these two systems will be integrated after site acceptance tests to fully establish the LI-VISTA facility for its intended functional operation.
Further, tender for procurement of "Centralized LN_2/GN_2 transfer line" in New Laboratory building housing the LI-VISTA facility has been initiated.
Both the outgassing systems, baking furnace, SOLIDWORKS CAD facility, CDS/VCMS prototype test racks with associated electronics/computers/workstations are also installed and setup in the laboratory.

Figure B.2.1: 20 m integrated vacuum vessel at institute's LIGO Lab.

Activities Towards Development of Control and Data System (CDS): The prototyping activities at IPR continue on standalone CDS test rack setup for LIGO India project. The existing test rack includes single IO chassis and a Supermicro make frontend computers (FE) connected through fiber optic cable. The FE is configured for the real-time LIGO CDS software running over Debian-10 Linux. The configured CDS Workstation is being used for analyzing engineering channels' data using LIGO tools.

Figure B.2.2: 80K Cryopump testing in progress at factory.

Figure B.2.3: 80K Cryopump testing in progress at factory.

A prototype Vacuum Control and Monitoring System (VCMS) Rack to operate and monitor existing outgassing measurement system is setup at the institute, following LIGO USA slow controls configuration. The 'Beckhoff' make automation hardware along with 'TwinCAT3' Software is used in existing outgassing system as well as other upcoming vacuum systems. The activities to interface the existing VCMS with EPICS based CDS using TwinCAT-IOC software have partially been completed for outgassing system. Similarly, this interface will be configured for other upcoming vacuum system. Finally this will help to monitor and control various vacuum parameters remotely for majority of LIGO India vacuum system prototype at the institute (Figure B.2.2 and B.2.3).

CHAPTER C , D & E

C. Academic Programme

D. Publications and Presentations

E. Other Activities

C. ACADEMIC PROGRAMMES

C.1 DOCTORATE PROGRAMME

During 2023-2024, a total number of 18 students (13 external and 5 internal) having Physics background have joined institute's PhD (Physics) programme. In addition, two (2) internal students, and 7 (Seven) new students from Engineering background under DAE Doctoral Fellowship Scheme (DDFS) have joined in institute's Engineering PhD programme. All of them are undergoing their course work. Overall, there are total One Hundred seven (107) PhD students in the institute, enrolled at present in HBNI for their PhD work.

Ph.D. THESIS SUBMITTED (during April 2023 - March 2024)

Studies on External Electrode Influence on Magnetized Plasma Properties in Linear Device
Satadal Das
Homi Bhabha National Institute, 2023

Superhydrophobic Surfaces Developed through Argon Plasma Processing For Self-Cleaning and Water Harvesting Technologies
Pachchigar Vivek Mahendrakumar
Homi Bhabha National Institute, 2023

Exploring Electron Plasmas Confined in Toroidal Magnetic Field: A 3D Particle-In-Cell Simulation Study
Swapnali Khamaru
Homi Bhabha National Institute, 2023

Spectroscopic Investigation of Neutral and Impurity Dynamics in the Edge Region of ADITYA-U Tokamak
Nandini Yadav
Nirma University, Ahmedabad

Linear and Nonlinear Waves in Spatially Non-Uniform 1D Vlasov-Poisson Plasmas
Sanjeev Kumar Pandey
Homi Bhabha National Institute, 2023

Design, Development and Characterization of Doppler Shifted Spectroscopic Diagnostic System for Negative Hydrogen Ion Beam in Fusion Application
Arnab Jyoti Deka
Homi Bhabha National Institute, 2023

Magnetohydrodynamic Study of Magnetic Island Coalescence - Role of Shear Flows
Jagannath Mahapatra
Homi Bhabha National Institute, 2023

Analysis, Design and Characterization of Metasurfaces for RCS Reduction
Priyanka Tiwari
Homi Bhabha National Institute, 2023

Nanopatterns Formation by Low-Energy Ions: Experiment and Simulation
Sukriti Hans
Homi Bhabha National Institute, 2023

Experimental Study of a Quasi Two-Dimensional Complex Plasma
Swarnima Singh
Homi Bhabha National Institute, 2023

Study on Rotating Dusty Plasma Equilibria and Their Excitations in Strongly Coupled Quasi-Localized Regime
Prince Kumar
Homi Bhabha National Institute, 2023

Excitation of Non-Linear Waves and Instabilities

in a Flowing Dusty Plasma
Krishan Kumar
Homi Bhabha National Institute, 2023

Development of a Rotating Tritium Target-Based D-T Neutron Generator System for Fusion Neutronics Studies
Sudhirsinh J Vala
Homi Bhabha National Institute, 2023

Guided and Leaky Modes Characteristics of Dielectric Loaded Helix Structure
Ajay Kumar Pandey
Homi Bhabha National Institute, 2023

Investigation of Thermal Plasma Jet for Low – Pressure Plasma Spraying
Ram Krushna Mohanta
Homi Bhabha National Institute, 2024

Synthesis and Studies on Some Surface Conditioning Materials and Techniques for Tokamak and Laboratory Vacuum Systems
Kumarpalsinh A. Jadeja
Saurashtra University, Rajkot

Studies on Extraction of an Ion beam and its Transport from a Multi-Cusp Gridded Ion Source
Rawat Bharatsingh Bhupendrasingh
Homi Bhabha National Institute, 2024

Control of Edge and Scrape-Off Layer Tokamak Plasma Turbulence
Vijay Shankar
Homi Bhabha National Institute, 2024

C.2 SUMMER SCHOOL PROGRAM (SSP)

The Summer School Programme for the year 2023 held at the institute between May 29 - July 7, 2023. For this 6 week programme, 16 students of science (10) and engineering streams (06) were selected. The students had a week of class room lectures on various domains of plasma physics and applications by institute faculties, followed by a five week project work. The students' projects were evaluated based on the presentations made on their projects at the end of the School. In the course of the school, the students visited most of the labs in the institute, FCIPT, ITER-India and institute's extension labs at Gandhinagar. The SSP-2023 students were also taken for Space Application Center (SAC), Ahmedabad.

C.3 UG/PG ACADEMIC PROJECTS FOR EXTERNAL STUDENTS

Around 65 students, pursuing Under Graduate (UG)/ Post Graduate (PG) courses in science and engineering, were engaged to do various academic projects with the institute faculties under their course curriculum in different fields of science and technology from various colleges/Universities/institutes during April 2023 to March 2024.

D. PUBLICATIONS AND PRESENTATIONS

D.1 Articles Publications

D.1.1 Journal Articles

Recovery of Electromagnetic Coils Insulation under Varying Conditions in ADITYA-U Tokamak
ROHIT KUMAR, J. GHOSH, R.L. TANNA, SUMAN AICH, TANMAY MACWAN, ADITYA-U TEAM
Fusion Engineering and Design, 189, 113481, April 2023

8.56-GHz Quasi-Optical Launcher System with Incident-Mode Selectivity on the QUEST Spherical Tokamak
H. IDEI, M. SAKAGUCHI, K. MISHRA, T. ONCHI, R. IKEZOE, O. WATANABE, Y. TANAKA, T. SAITO, T. IDO, K. HANADA
Fusion Engineering and Design, 189, 113479, April 2023

Magnetic Field Induced Electron Temperature Inhomogeneity Effects on Discharge Properties in Cylindrical Capacitively Coupled Plasmas
SWATI DAHIYA, PAWANDEEP SINGH, SATADAL DAS, NISHANT SIRSE, SHANTANU KUMAR KARKARI
Physics Letters A, 468, 128745, April 2023

Uniform Plasma Generation with Filament Assisted DC Discharge in a Linear Plasma Device
DIBYAJYOTI BORA, ARITRA TARAFDER, SUBIR BISWAS, MALAY BIKAS CHOWDHURI and JOYDEEP GHOSH
Physica Scripta, 98, 045618, April 2023

Study of Plasma Sheath in the Presence of Dust Particles in a Magnetic Mirror-Like Field Configuration K. DEKA, G. SHARMA, R. PAUL, R. MOULICK, S. ADHIKARI, S. S. KAUSIK, B.K. SAIKIA
Physica Scripta, 98, 045608, April 2023

Hairpin Probe Assisted Saturation Current Ratio Method to Determine Plasma Electronegativity
PAWANDEEP SINGH, SWATI DAHIYA, AVNISH KUMAR PANDEY and SHANTANUKUMAR KARKARI
Plasma Sources Science and Technology, 32, 045013, April 2023

Confinement Controlled Dynamical Structural Rearrangement in a Quasi-2D Dusty Plasma Crystal
SWARNIMA SINGH, P. BANDYOPADHYAY, KRISHAN KUMAR, A. SEN
Physics of Plasmas, 30, 043706, April 2023

SITAR: A Code for ICRH Antenna-Plasma Coupling
ASIM KUMAR CHATTOPADHYAY
IEEE Transactions on Plasma Science, 51, 1188, April 2023

Spatial Mapping of Low Pressure Cluster Jets using Rayleigh Scattering
MILAAN PATEL, B.R. GEETHIKA, JINTO THOMAS, HEM JOSHI
Scientific Reports, 13, 6338, April 2023

Ion-Driven Destabilization of a Toroidal Electron Plasma - A 3D3V PIC Simulation
S. KHAMARU, R. GANESH, M. SENGUPTA
Physics of Plasmas, 30, 042107, April 2023

Transition of a 2D Crystal to a Non-Equilibrium Two-Phase Coexistence State
SWARNIMA SINGH, P. BANDYOPADHYAY, KRISHAN KUMAR, M. G. HARIPRASAD, S. ARUMUGAM, A. SEN
Physics of Plasmas, 30, 043704, April 2023

Effect of Positive Polarity in an Inertial Electrostatic Confinement Fusion Device: Electron Confinement, X-Ray Production, and Radiography
DARPAN BHATTACHARJEE, SMRUTI RANJAN MOHANTY and SAYAN ADHIKARI
Fusion Science and Technology, 79, 671, April 2023

Thermostructural Analysis of Large Cryopumping Test Facility
HEMANG S. AGRAVAT, SAMIRAN S. MUKHERJEE, VISHAL GUPTA, PARESH PANCHAL, PRATIK NAYAK, JYOTI SHANKAR MISHRA and RANJANA GANGRADEY
Fusion Science and Technology, 79, 683, April 2023

A Single-Step Plasma Method for Rapid Production of 2D, Ferromagnetic, Surface Vacancy-Engineered MoO_{3-X} Nanomaterials, for Photothermal Ablation of Cancer
MIZANUR RAHMAN, DEEPAK B PEMMARAJU, UPADHYAYULA SURYANARAYANA MURTY, SARAT PHUKAN, UDAY P DESHPANDE, VASANT SATHE and MAYUR KAKATI
Nanotechnology, 34, 195601, May 2023

Neutronic Simulation of Medical Radioisotope 99Mo and 177Lu Production in IPR 14 MeV Neutron Generator Facility
H. L. SWAMI, A. SAXENA, S. VALA, M. ABHANGI, RATNESH KUMAR, RAJESH KUMAR
Applied Radiation and Isotopes, 195, 110743, May 2023

Experimental Investigation of Rarefied Flows through Supersonic Nozzles
MILAAN PATEL, JINTO THOMAS, HEM CHANDRA JOSHI
Vacuum, 211, 111909, May 2023

Synthesis of the Chemically Durable Glass-Ceramic Matrix for Radioactive Waste Immobilisation
RITU KUMARI PILANIA, NIDHI PATHAK, MAHESH SAINI, KANDATHIL PARAMBIL SOORAJ, MUKESH RANJAN, CHARU LATA DUBE
Ceramics International, 49, 15931, May 2023

Gyrokinetic Simulations of Electrostatic Microturbulence in ADITYA-U Tokamak
TAJINDER SINGH, DEEPTI SHARMA, TANMAY MACWAN, SARVESHWAR SHARMA, JOYDEEP GHOSH, ABHIJIT SEN, ZHIHONG LIN and ANIMESH KULEY
Nuclear Fusion, 63, 056008, May 2023

Optimization of Input Parameters of ANN–Driven Plasma Source through Nature-Inspired Evolutionary Algorithms
VIPIN SHUKLA, MAINAK BANDYOPADHYAY
Intelligent Systems with Applications, 18, 200200, May 2023

Influence of γ'N and ε'N Phases on the Properties of AISI 304L after Low-Temperature Plasma Nitrocarburizing
JEET VIJAY SAH, PRAVIN KUMARI DWIVEDI, SUBROTO MUKHERJEE, GHANSHYAM JHALA and ALPHONSA JOSEPH
Journal of Vacuum Science & Technology A, 41, 033101, May 2023

Secondary Electron Emission and Collisional Effects in a Two-Electron Temperature Plasma Sheath
GUNJAN SHARMA, RUPALI PAUL, KISHOR DEKA, RAKESH MOULICK, SAYAN ADHIKARI, SIDDHARTHA SANKAR KAUSIK, BIPUL KUMAR SAIKIA
Contributions to Plasma Physics, 63,

e202300020, May 2023

Experimental and Theoretical Study of the 65Cu(n,p) 65Ni Reaction Cross Section from Reaction Threshold up to 25 MeV
R. K. SINGH, N. L. SINGH, MAYUR MEHTA, RAKESH CHAUHAN, H. KUMAWAT, RAJNIKANT MAKWANA, S. V. SURYANARAYANA, B. K. NAYAK, H. NAIK, JAN VARMUZA, and K. KATOVSKY
Physical Review C, 107, 054607, May 2023

Design, Development, and Analysis of 1 to 4, Anti-Phase in-Line RF Power Splitter for Low-Frequency ISM Band Applications
CHIRAG SENJALIYA, SHANTANU KUMAR KARKARI
AIP Advances, 13, 055001, May 2023

Selective Generation of Reactive Oxygen Species in Plasma-Activated Water using Co2 Plasma
VIKAS RATHORE, SUDHIR KUMAR NEMA
Journal of Vacuum Science & Technology A, 41, 043001, May 2023

Application of Similarity Theory to Predict Operational Characteristics of a DC Plasma Torch Under Low-Pressure Condition
RAM KRUSHNA MOHANTA, DEVILAL KUMAWAT, G. RAVI and KUMUDNI TAHILIANI
The European Physical Journal D, 77, 89, May 2023

Study of Physico-Chemical and Antibacterial Properties of DBD Plasma Treated Ahimsa Silk Coated With Natural Active Agent
MUMAL SINGH, MONA VAJPAYEE, LALITA LEDWANI, HEMEN DAVE and SUDHIR K NEMA
Physica Scripta, 98, 065001, June 2023

Tritium-Titanium Target Degradation due to Deuterium Irradiation for DT Neutron Production
MAYANK RAJPUT, H L SWAMI, SUDHIRSINH VALA, M ABHANGI, R KUMAR and RAJESH KUMAR
Nuclear Fusion, 63, 066033, June 2023

3D Thermo-Fluid MHD Simulation in a Complex Flow Geometry
A. PATEL, R. BHATTACHARYAY
Fusion Engineering and Design, 191, 113558, June 2023

Lane Formation in 3D Driven Pair-Ion Plasmas: I Parallel External Forcing
VISHAL KUMAR PRAJAPATI, SWATI BARUAH and RAJARAMAN GANESH
Journal of Plasma Physics, 89, 905890301, June 2023

Lane Formation in 3D Driven Pair-Ion Plasmas: II Non-Parallel External Forcing
VISHAL KUMAR PRAJAPATI, SWATI BARUAH and RAJARAMAN GANESH
Journal of Plasma Physics, 89, 905890302, June 2023

Test Results of a Prototype HTS Current Lead With MgB2 and NbTi Superconducting Joints NITIN BAIRAGI, VIPUL L. TANNA, HIREN NIMAVAT, DASHRATH SONARA, ROHITKUMAR PANCHAL, ATUL GARG, GAURANG MAHESURIA, RAKESHKUMAR PATEL, DIKENS CHRISTIAN, PRADIP PANCHAL,
GAURAV PURWAR, UPENDRA PRASAD and RAJU DANIEL
IEEE Transactions on Applied Superconductivity, 33, 4801408, June 2023

Anisotropic Electrical Properties of 200MeV

Ag+15 Ion Irradiated Manganite Films
BHAGYASHREE UDESHI, BHARAVI HIRPARA, SUKRITI HANS, M. RANJAN, M.R. GONAL, K. ASOKAN, R.K. TRIVEDI, A.D. JOSHI, P.S. SOLANKI, N.A. SHAH
Materials Chemistry and Physics, 301, 127688, June 2023

Behavior of Ion Acoustic Solitons in A Two-Electron Temperature Plasma of a Multi-Pole Line Cusp Plasma Device
ZUBIN SHAIKH, A. D. PATEL, P. K. CHATTOPADHYAY, JOYDEEP GHOSH, H. H. JOSHI and N. RAMASUBRAMANIAN
AIP Advances, 13, 065021, June 2023

Effect of Ambient Gas on Grain Growth of CZTS Layer: Study on Device Efficiency
SAGAR AGRAWAL, C. BALASUBRAMANIAN and SUBROTO MUKHERJEE
Journal of Materials Science: Materials in Electronics, 34, 1387, June 2023

Argon, Neon, and Nitrogen Impurity Transport in the Edge and SOL Regions of a Tokamak
SHRISH RAJ, N. BISAI, VIJAY SHANKAR and A. SEN
Physics of Plasmas, 30, 062302, June 2023

Variation in Defects and Properties in Composite of ZnO and α-Fe2O3 for Sustainable Wastewater Treatment
BORIS WAREPPAM, K. PRIYANANDA SINGH, N. JOSEPH SINGH; SUBRATA GHOSH, N. AOMOA, V. K. GARG, A. C. OLIVEIRA and L. HEROJIT SINGH
Journal of Applied Physics, 133, 235305, June 2023

Impact of Edge Biasing On the Cross-Field Transport and Power Spectra
VIJAY SHANKAR, N. BISAI, SHRISH RAJ and A. SEN
Physics of Plasmas, 30, 062301, June 2023

Simulation of Silicon Etching in NF3 Plasma Reactor
H L SWAMI, V MEHTA, YOGENDRA KUMAR, CHETAN JARIWALA and RAJESH KUMAR
Pramana - Journal of Physics, 97, 101, June 2023

Heat Transfer and Fluid Flow Analysis of Pebble Bed and Its Verification with Artificial Neural Network
CHIRAG SEDANI, PARITOSH CHAUDHURI, MANOJ KUMAR GUPTA
Nuclear Materials and Energy, 35, 101439, June 2023

Theory of Plasma Blob Formation and its Numerical and Experimental Validations
N. BISAI, SANTANU BANERJEE, S.J. ZWEBEN and A. SEN
Reviews of Modern Plasma Physics, 7, 22, June 2023

Behavior of Ion Acoustic Solitons in a Two-Electron Temperature Plasma of a Multi-Pole Line Cusp Plasma Device (MPD)
ZUBIN SHAIKH, A. D. PATEL, P. K. CHATTOPADHYAY, JOYDEEP GHOSH, H. H. JOSHI, N. RAMASUBRAMANIAN
AIP Advance, 13, 065021, June 2023

Lessons Learned after Three Years of SPIDER Operation and the First MITICA Integrated Tests
D. MARCUZZI, V. TOIGO, M. BOLDRIN, G. CHITARIN, S. DAL BELLO, L. GRANDO, A. LUCHETTA, R. PASQUALOTTO, M. PAVEI, G. SERIANNI, L. ZANOTTO, R. AGNELLO, P. AGOSTINETTI, M. AGOSTINI, D. APRILE, M.

BARBISAN, M. BATTISTELLA, G. BERTON, M. BIGI, M. BROMBIN, V. CANDELA, V. CANDELORO, A. CANTON, R. CASAGRANDE, C. CAVALLINI, R. CAVAZZANA, L. CORDARO, N. CRUZ, M. DALLA PALMA, M. DAN, A. DE LORENZI, R. DELOGU, M. DE MURI, M. DE NARDI, S. DENIZEAU, M. FADONE, F. FELLIN, A. FERRO, E. GAIO, C. GASPARRINI, F. GNESOTTO, P. JAIN, A. LA ROSA, D. LOPEZ-BRUNA, R. LORENZINI, A. MAISTRELLO, G. MANDUCHI, S. MANFRIN, N. MARCONATO, I. MARIO, G. MARTINI, R. MILAZZO, T. PATTON, S. PERUZZO, N. PILAN, A. PIMAZZONI, C. POGGI, N. POMARO, B. POURADIER-DUTEIL, M. RECCHIA, A. RIGONI-GAROLA, D. RIZZETTO, A. RIZZOLO, F. SANTORO, E. SARTORI, B. SEGALINI, A. SHEPHERD, M. SIRAGUSA, P. SONATO, A. SOTTOCORNOLA, E. SPADA, S. SPAGNOLO, M. SPOLAORE, C. TALIERCIO, P. TINTI, P. TOMSIČ, L. TREVISAN, M. UGOLETTI, M. VALENTE, M. VALISA, F. VERONESE, M. VIGNANDO, P. ZACCARIA, R. ZAGORSKI, B. ZANIOL, M. ZAUPA, M. ZUIN, M. CAVENAGO, D. BOILSON, C. ROTTI, H. DECAMPS, F. GELI, A. SHARMA, P. VELTRI, J. ZACKS, M. SIMON, F. PAOLUCCI, A. GARBUGLIA, D. GUTIERREZ, A. MASIELLO, G. MICO, C. LABATE, P. READMAN, E. BRAGULAT, L. BAILLY-MAITRE, G. GOMEZ, G. KOUZMENKO, F. ALBAJAR, M. KASHIWAGI, H. TOBARI, A. KOJIMA, M. MURAYAMA, S. HATAKEYAMA, E. OSHITA, T. MAEJIMA, N. SHIBATA, Y. YAMASHITA, K. WATANABE, N.P. SINGH, M.J. SINGH, H. DHOLA, U. FANTZ, B. HEINEMANN, C. WIMMER, D. WUNDERLICH, K. TSUMORI, G. CROCI, G. GORINI, A. MURARO, M. REBAI, M. TARDOCCHI, L. GIACOMELLI, D. RIGAMONTI, F. TACCOGNA, D. BRUNO, M. RUTIGLIANO, S. LONGO, S. DEAMBROSIS, E. MIORIN, F. MONTAGNER, A. TONTI, F. PANIN

Fusion Engineering and Design, 191, 113590, June 2023

Synthetic Data Generation using Generative Adversarial Network for Tokamak Plasma Current Quench Experiments

BHRUGU DAVE, SARTHAK PATEL, RISHI SHIVANI, SHISHIR PUROHIT, BHASKAR CHAUDHURY

Contributions to Plasma Physics, 63, e202200051, June-July 2023

Revisiting Kinematic Fast Dynamo in Three-Dimensional Magnetohydrodynamicplasmas: Dynamo Transition from Non-Helical To Helical Flows

SHISHIR BISWAS and RAJARAMAN GANESH

Physica Scripta, 98, 075607, July 2023

Design, Analysis, Fabrication and Testing of 100 kV, 100mA DC Full-Wave Voltage Multiplier (FWVM) Modular Unit for Accelerator Power Supply

URMIL THAKER, SANTOSH C. VORA, AMARDAS A, AMAL S., KUMAR SAURABH, ARITRA CHAKRABORTY, PAUL CHRISTIAN, ASHOK MANKANI, UJJWAL BARUAH

Fusion Engineering and Design, 192, 113612, July 2023

Characterizing a Ka-Band FMCW Reflectometer

J.J.U. BUCH and S.K. PATHAK

Journal of Instrumentation, 18, P07022, July 2023

Systematic Study of (p, n) and (p, 2n) Reactions on 110Cd

VIBHUTI VASHI, RAJNIKANT MAKWANA, B. QUINTANA, M. H. MEHTA, R.K. SINGH,

B.K. SONI, R. CHAUHAN, S. MUKHERJEE, M. ABHANGI, S. VALA, N.L. SINGH, G.B. PATEL, S.V. SURYANARAYANA, B.K. NAYAK, S.C. SHARMA,
T.N. NAG, Y. KAVUN
Radiation Physics and Chemistry, 208, 110933, July 2023

3D Computational Fluid Dynamics Analysis of PINI Ion Source Back Plate under High Heat Flux Condition
TEJENDRA PATEL, MUKTI RANJAN JANA, UJJWAL BARUAH
Fusion Engineering and Design, 192, 113841, July 2023

Mid-Infrared Radiation from Semiconductor Plasmas Using Extraordinary Mode of Lasers
KRISHNA GOPAL, AKHILESHWAR PRASAD SINGH, MRITYUNJAY KUNDU, AJIT UPADHYAY and PRATEEK VARSHNEY
Brazilian Journal of Physics, 53, 118, July 2023

Computational and Experimental Study of Nonequilibrium Flow in Plasma Wind Tunnel
VINAY UNNIKRISHNAN, NANDINI YADAVA, NIRAL VIRANI, JOYDEEP GHOSH, N. SREENIVAS, L. ARAVINDAKSHAN PILLAI and KOWSIK BODI
Journal of Thermophysics and Heat Transfer, 37, 1.T6357, July 2023

Spatial Flux and Energy Asymmetry in a Low Pressure Capacitively Coupled Plasma Discharge Excited By Sawtooth Waveform: A Harmonic Study
SARVESHWAR SHARMA, NISHANT SIRSE and MILES M TURNER
Physics of Plasmas, 30, 073506, July 2023

Study of the Evolution of Pulsed Plasma under an External Longitudinal Magnetic Field
A. AHMED, S. SINGHA, N. K. NEOG and T. K. BORTHAKUR
Journal of Applied Physics, 134, 023301, July 2023

Interaction of a Precursor Soliton with Wake Structure in a Flowing Dusty Plasma
KRISHAN KUMAR, P. BANDYOPADHYAY, SWARNIMA SINGH and A. SEN
Physics of Plasmas, 30, 073701, July 2023

Measurement of Neutron Capture Cross Section on 71Ga at 2.15 and 3.19 MeV and the Uncertainty Propagation and Covariance Analysis
REBECCA PACHUAU, AMAN GANDHI, NAMRATA SINGH, AJAY KUMAR TYAGI, MAYUR MEHTA, SARASWATULA SURYANARAYAN, L. S. DANU, B K NAYAK and B LALREMRUATA
Chinese Physics C, 47, 074001, July 2023

Design, Manufacturing, and Testing of 0.35/25 kV, 20 kHz Transformers for Particle Accelerators
ARITRA CHAKRABORTY, PAUL D. CHRISTIAN, AMAL S, SAURABH KUMAR, ANANYA KUNDU, ASHOK MANKANI, UJJWAL K. BARUAH
Review of Scientific Instruments, 94, 74706, July 2023

Assessment and Optimization of Output Filter for Microsecond Transient in PSM-Based Megawatt HVPS
DISHANG V. UPADHYAY, SANTOSH C. VORA, MANISHA T. SHAH and N. P. SINGH
IEEE Transactions on Plasma Science, 51, 1988, July 2023

Effect of Cage Bias and Electron Emission on the Two-Electron Temperature Groups in a Hot

Cathode Discharge
JOCELYN SANGMA, NARAYAN SHARMA, MONOJIT CHAKRABORTY and MAINAK BANDYOPADHYAY
Physica Scripta, 98, 075608, July 2023

Comparative Wettability Study of Bulk and Thin Film of Polytetrafluoroethylene after Low Energy Ion Irradiation
VIVEK PACHCHIGAR, BASANTA KUMAR PARIDA, SEBIN AUGUSTINE, SUKRITI HANS, MAHESH SAINI, K.P. SOORAJ, MUKESH RANJAN
Thin Solid Films, 777, 139888, July 2023

Methotrexate Degradation in Artificial Wastewater Using Non-Thermal Pencil Plasma Jet VIKAS RATHORE, SHRUTI PATEL, AKANKSHA PANDEY, JIGNASA SAVJANI, SHITAL BUTANI, HEMAN DAVE and SUDHIR KUMAR NEMA
Environmental Science and Pollution Research, s11356-023-28502-z, July 2023

Indigenous Development of Epoxy Resin System for Cryogenic Services and Fusion Application
RAJIV SHARMA, ALKESH M. MAVANI and V. L. TANNA
Fusion Science and Technology, 80, 230, August 2023

Gyrokinetic Simulation of Short Wavelength Ion Temperature Gradient Instabilities in the ADITYA-U Tokamak
AMIT KUMAR SINGH, JAGANNATH MAHAPATRA, JUGAL CHOWDHURY, DEEPAK AGGARWAL, THOMAS HAYWARD-SCHNEIDER, RAJARAMAN GANESH, EMMANUEL LANTI and LAURENT VILLARD
Nuclear Fusion, 63, 086029, August 2023

Pinning of Graphene for Conformal Wrinkling Over a Soft Corrugated Substrate through Prestretch-Release Process
MUKESH PANDEY, B.K. PARIDA, M. RANJAN, RAJEEV AHUJA and RAKESH KUMAR
Applied Surface Science Advances, 16, 100433, August 20

Reconstruction Algorithm for the Runaway Electron Energy Distribution Function of the ITER Hard X-Ray Monitor
ANSH PATEL, SANTOSH P PANDYA, ALEXANDER E SHEVELEV, E M KHILKEVITCH, MARGARITA ILIASOVA, RICHARD O'CONNOR, RAPHAEL TIEULENT, ROBIN BARNSLEY and ALEXANDER N MOKEEV
Physica Scripta, 98, 085604, August 2023

Analysis of the Coupling Characteristics of Ion Cyclotron Resonance Heating Antenna of Small Tokamak with the Help of 2D and 3D Antenna Codes
ASIM KUMAR CHATTOPADHYAY
Pramana - Journal of Physics, 97, 125, August 2023

Kinetic Simulation of a 50 mTorr Capacitively Coupled Argon Discharge over a Range of Frequencies and Comparison to Experiments
SAURABH SIMHA, SARVESHWAR SHARMA, ALEXANDER KHRABROV, IGOR KAGANOVICH, JONATHAN POGGIE, SERGEY MACHERET
Physics of Plasmas 30, 083509, August 2023

Runaway Electron Mitigation with Pulsed Localized Vertical Magnetic Field Perturbation in ADITYA Tokamak
R.L. TANNA, S. PATEL, J. GHOSH, CHETNA CHAUHAN, A. AMARDAS, P.K.

CHATTOPADHYAY, K.A. JADEJA, Y.S. JOISA, U.C. NAGORA, P.K. ATREY, M.B. CHOWDHURI, R. MANCHANDA, Y.C. SAXENA and the ADITYA TEAM
Nuclear Fusion, 63, 086011, August 2023

Role of Micro- and Nano-CeO2 Reinforcements on Characteristics and Tribological Performance of HVOF Sprayed Cr3C2-NiCr Coatings
HETAL R. CHAUHAN, SEKAR SALADI, SAHIL VARIYA, AJAYKUMAR SOLANKI, SATISH TAILOR, K.P. SOORAJ, MUKESH RANJAN, SHRIKANT JOSHI
Surface and Coatings Technology, 467, 129684, August 2023

Experimental Studies on the Roles of Space Charge Neutralization in a Ring Cusp Ion Source
BHARAT SINGH RAWAT, S. K. SHARMA, V. PRAHLAD, B. CHOKSI, U. K. BARUAH **IEEE Transactions on Plasma Science, 51, 2218, August 2023**

Development of Isotopically Labelled 65Cu Embedded PMMA-65 CuO Nanocomposites for Detection and Quantification of PMMA Bone Cement Degradation at Trace Levels
BHARTI MALVI, SWAROOP CHAKRABORTY, RAMESH CHAUDHARI, ASHUTOSH KUMAR, BALASUBRAMANIAN C., SUPERB K. MISRA
Materials Today Communications, 36, 106849, August 2023

Changing Pattern of N2 Dissociation in N2-Ar RF Plasma during E–H Mode Transition
A MUKHERJEE, M CHAKRABORTY, N SHARMA and P K SAHA
Plasma Sources Science and Technology, 32, 085004, August 2023

Effect of Stirring on Characteristics of Electrochemically Exfoliated Graphene
G. AWASTHI, K. MISTRY, N. JAMNAPARA, M. SALOT, K. SANTHY, D. MANDAL, S.K. CHAUDHURY
Materialia, 30, 101818, August 2023

Investigating the Role of Plasma-Activated Water on the Growth of Freshwater Algae Chlorella Pyrenoidosa and Chlorella Sorokiniana
VIKAS RATHORE and SUDHIR KUMAR NEMA
Plasma Chemistry and Plasma Processing, 44, 367, August 2023

Imidazole-Functionalized Plasma-Treated ZnO and α-Fe2O3 Composites for Catalytic Degradation of Dye Catalytic Degradation of Dye
BORIS WAREPPAM, N. JOSEPH SINGH, K. PRIYANANDA SINGH, N. AOMOA and L. HEROJIT SINGH
International Journal of Modern Physics B, 2450331, August 2023

O-Mode Reflectometry on Aditya-U
J.J.U. BUCH, S.K. PATHAK, K.M PATEL, ADITYA-U TEAM
Fusion Engineering and Design, 193, 113746, August 2023

Pressureless Manufacturing of High Purity Ti3AlC2 MAX Phase Material: Synthesis and Characterisation
VYOM DESAI, AROH SHRIVASTAVA, ARUNSINH ZALA, TEJAS PAREKH, SUROJIT GUPTA C, N. I. JAMNAPARA
Vacuum, 214, 112221, August 2023

Automated Plasma Probing System for Laboratory Experiments in High Vacuum Using Closed Loop Control
ROSH ROY, RITESH SUGANDHI, MRITUNJAY

KUMAR, PRABAL K CHATTOPADHYAY
Fusion Engineering and Design, 193, 113849, August 2023

Effect of Charged Dust Grains on the Electrojet Instabilities
SANJIB SARKAR, JYOTI KUMAR ATUL, MODHUCHANDRA LAISHRAM, DANDAN ZOU and KOSTYA (KEN) OSTRIKOV
Physica Scripta, 98, 085607, August 2023

Development and Application of Vibration Diagnostics for Condition Monitoring in High Heat Flux Test Facility at IPR
KEDAR BHOPE, MAYUR MEHTA, SUNIL BELSARE, SAMIR KHIRWADKAR, VINAY MENON, RAJAMANNAR SWAMY, PRAKASH MOKARIYA, TUSHAR PATEL and NIKUNJ PATEL
Journal of Vibration Engineering and Technologies, s42417-023-01102-4, August 2023

Plasma Sheath with Multi-Species of Positive Ions and Surface Produced Negative Ions
SUTAPA SAMANTA, RAKESH MOULICK, P. J. BHUYAN, and B. J. SAIKIA
Contributions to Plasma Physics, 63, e202300044, September 2023

Effect of Laser Intensity Redistribution on Terahertz Field Generation via Laser Wakefield in a Magnetized Plasma
A. P. SINGH, P. VARSHNEY, A. JAIN, D. N. GUPTA, M. KUNDU and K. GOPAL
Indian Journal of Physics, 97, 3119, September 2023

Studies of Physio-Chemical Changes of Dielectric Barrier Discharge Plasma Treated Aramid Fibers
SADAF JETHVA, FALGUNI BHABHOR, CHIRAYU PATIL, VYOM DESAI, ARUNSINH ZALA, NISHA CHANDWANI, C. BALASUBRAMANIAN, N.I. JAMNAPARA
Vacuum, 215, 112313, September 2023

SERS Sensing Of Metanil Yellow in Turmeric Solution Using Self-Organized Nanoparticle Arrays Grown On Ion Beam Patterned Soda-Lime Glass
SEBIN AUGUSTINE, K P SOORAJ, MAHESH SAINI, SUKRITI HANS, BASANTA KUMAR PARIDA, VIVEK PACHCHIGAR, MUKESH RANJAN
Photonics and Nanostructures - Fundamentals and Applications, 56, 101166, September 2023

Preliminary Engineering Design of Vacuum Thermal Shielded Pb-Li Loop Section for Potential Nuclear Fusion Application
P A RAYJADA, V MEHTA, P BAWANKAR, RANJITH KUMAR S, A PATEL, R BHATTACHARYAY
Fusion Engineering and Design, 194, 113932, September 2023

Discharge Characteristics of a Low-Pressure Geometrically Asymmetric Cylindrical Capacitively Coupled Plasma with an Axisymmetric Magnetic Field
SWATI DAHIYA , PAWANDEEP SINGH, YASHSHRI PATIL, SARVESHWAR SHARMA, NISHANT SIRSE, SHANTANU KUMAR KARKARI
Physics of Plasmas, 30, 93505, September 2023

Design and Analysis of Cooling Jacket Developed for Vacuum Power Tubes by Multiphase Cooling
ROHIT ANAND, VIKASH J LAKHERA
Engineering Research Express, 5, 035060, September 2023

Development of a Fast Valve Assisted Mechanical

Launcher for Cryogenic Pellets
JYOTI S. MISHRA, PARESH PANCHAL, SAMIRAN MUKHERJEE, VISHAL GUPTA, HEMANG S. AGRAVAT, PRATIKKUMAR NAYAK and RANJANA GANGRADEY
Plasma and Fusion Research, 18, 2405076, September 2023

Investigation of Temporal Evolution of Hard X-Ray Spectrum from Neon-Seeded Plasma of ADITYA-U Tokamak
SHISHIR PUROHIT, MANOJ K. GUPTA, MALAY B. CHOWDHURI, UMESH NAGORA, YASHIKA TAUNK, ABHISHEK KUMAR, KAJAL GARG, SURYA K. PATHAK, KUMARPALSINH A. JADEJA, ROHIT KUMAR, KUMUDNI TAHILIANI,
SAMEER KUMAR, KAUSHAL M. PATEL, RAKESH L. TANNA, SUPRIYA A. NAIR, JOYDEEP GHOSH and ADITYA-U TEAM
Plasma and Fusion Research, 18, 2402079, September 2023

Influence of RF Power on Wettability, Morphology and Bacterial Adhesion Properties of Oxygen Plasma Treated Silicone Catheter Surfaces
PURVI DAVE, C. BALASUBRAMANIAN, SUKRITI HANS, VIKAS RATHORE and S. K. NEMA
Plasma Chemistry and Plasma Processing, 44, 565, September 2023

Formation of Multiple Double Layers in the Presence of Grounded Ring in RF Expanding Plasma
P.K. SAHA, M. CHAKRABORTY, D. DUTTA, N. SHARMA A and A. MUKHERJEE
Physics Letters A, 481, 129016, September 2023

Role of Pinch in Argon Impurity Transport in Ohmic Discharges of Aditya-U Tokamak
K. SHAH, J. GHOSH, S. PATEL, M. B. CHOWDHURI, K. A. JADEJA, G. SHUKLA, T. MACWAN, A. KUMAR, S. DOLUI, K. SINGH, R. L. TANNA, K. M. PATEL, R. DEY, R. MANCHANDA, N. RAMAIYA, R. KUMAR, S. AICH, N. YADAVA, S. PUROHIT, M. K. GUPTA, U. C. NAGORA, S. K. PATHAK, P. K. ATREY and K. B. K. MAYYA
Scientific Reports, 13, 16087, September 2023

Role of Translational Noise on Current Reversals of Active Particles on Ratchet
ANSHIKA CHUGH and RAJARAMAN GANESH
Scientific Reports, 13, 16154, September 2023

Enhancing the Physicochemical Properties and Reactive Species Concentration of Plasma Activated Water Using an Air Bubble Diffuser
VIKAS RATHORE, NIRAV I. JAMNAPARA, and SUDHIR KUMAR NEMA
Physics Letters A, 482, 129035, September 2023

Ion Heating in Laser Interacting with Magnetized Plasma
ROHIT JUNEJA, TRISHUL DHALIA, LAXMAN PRASAD GOSWAMI, SRIMANTA MAITY, DEVSHREE MANDAL, and AMITA DAS
Plasma Physics and Controlled Fusion, 65, 095005, September 2023

Enhancement of Shelf Life of Citrus Limon L. (Lemon) Using Plasma Activated Water
VIKAS RATHORE, SUDHIR KUMAR NEMA
Plasma Chemistry and Plasma Processing, 43, 1109, September 2023

Extraction of Energetic N2 Neutrals for Efficient Plasma Food Processing of Finger Millet Flour
M. PERUMAL, A. SARAVANAN, SNEHA LATHA KOMMUGURI, PRINCE ALEX, K. V. SUNOOJ, MAHESWARAN MANI, P.

BHARATHI and SURAJ KUMAR SINHA
Plasma Chemistry and Plasma Processing, 44, 471, September 2023

Residual Load Capacity of HVFA Reinforced Concrete after Elevated Temperature Heating: Experimental and Analytical Study
M.S. MOJIBI, M. SHARIQ, A. MASOOD, F. MAHDI, H. ABBAS
Construction and Building Materials, 399, 132569, October 2023

Manifestation of Improvement in Regenerator Performance of a Low and High-Frequency Pulse Tube Cryocooler Using Layered Pattern
ABHINAV B. DESAI, ROHAN DUTTA, SHASHI KANT VERMA, AVIJIT DEWASI, HEMANG AGRAVAT, VISHAL GUPTA, SAMIRAN S. MUKHERJEE, JYOTI SHANKAR MISHRA, PARESH PANCHAL, PRATIK A. NAYAK, RANJANA GANGRADEY
Thermal Science and Engineering Progress, 45, 102112, October 2023

A Case Study of Thermal Mixing Behavior of Hot and Cold Fluid in T-Junction With/Without Mixing Jets
SANDEEP RIMZA, PARITOSH CHAUDHURI, BRIJESH KUMAR YADAV, SAYANTAN MUKHERJEE
Case Studies in Thermal Engineering, 50, 103417, October 2023

Experience of Pumping the Vacuum Vessel of SST-1 during the Baking Cycle with Indigenously Developed Liquid Nitrogen Cooled Sorption Pump
VISHAL GUPTA , SAMIRAN S. MUKHERJEE, AVIJIT DEWASI, JYOTI SHANKAR MISHRA , PRATIK A. NAYAK, PARESH PANCHAL, VIPUL L. TANNA, YUVAKIRAN PARAVASTU, DILIP C. R AVAL, ZIAUDDIN KHAN, RAJU DANIEL,
SIJU GEORGE, ATUL GARG, L N SRIKANTH, KALPESH R. DHANANI, ROHAN DUTTA, ABHINAV B. DESAI, HEMANG S. AGRAVAT and RANJANA GANGRADEY
Fusion Engineering and Design, 195, 113950, October 2023

Manifold Enhancement in the Near-Field and SERS Efficiency of all-Sputter Grown Ag-Nanoparticles on Al-Film Based Mirror Structures
MAHESH SAINI, VIVEK PACHCHIGAR, SEBIN AUGUSTINE, UMESH KUMAR GAUR, SOORAJ K.P., MUKESH RANJAN
Surfaces and Interfaces, 41, 103263, October 2023

Activation Cross Section for the (n,2n) and (n,p) Reactions on 103Rh, 48Ti and 52Cr From Reaction Threshold up to 25 MeV Energy Region
R.K. SINGH, N.L. SINGH, MAYUR MEHTA, RAKESH CHAUHAN, S.V. SURYANARAYANA, RAJNIKANT MAKWANA, B.K. NAYAK, H. NAIK, JAN VARMUZA, and K. KATOVSKY
Applied Radiation and Isotopes, 200, 110949, October 2023

Effect of External Magnetic Field and Dust Grains on the Properties of Ion-Acoustic Waves
K. DEKA, R. PAUL, G. SHARMA, N. DAS, S. ADHIKARI, R. MOULICK, S.S. KAUSIK, B.K. SAIKIA, O.H. CHIN and C.S. WONG
Journal of Plasma Physics, 89, 905890502, October 2023

Shielded Ionisation Discharge (SID) Probe for Spatiotemporal Profiling of Pulsed Molecular Beam
MILAAN PATEL, JINTO THOMAS, HEM CHANDRA JOSHI
Review of Scientific Instruments, 94, 103307,

October 2023

Effect of Chamber Pressure on the Output Characteristics of a Low-Pressure DC Plasma Torch
RAM KRUSHNA MOHANTA, DEVILAL KUMAWAT and G.RAVI
Journal of Applied Physics, 134, 153302, October 2023

High-Temperature Wear and Frictional Performance of Plasma-Nitrided AISI H13 Die Steel
ASHISH KUMAR, MANPREET KAUR, ALPHONSA JOSEPH, GHANSHYAM JHALA, TARUN NANDA and SURINDER SINGH
Lubricants, 11, 448, October 2023

Direct Implicit and Explicit Energy-Conserving Particle-In-Cell Methods for Modeling of Capacitively Coupled Plasma Devices
HAOMIN SUN, SOHAM BANERJEE, SARVESHWAR SHARMA, ANDREW TASMAN POWIS, ALEXANDER V. KHRABROV, DMYTRO SYDORENKO, JIAN CHEN, IGOR D. KAGANOVICH
Physics of Plasmas, 30, 103509, October 2023

Whistler Heat Flux Instability Governed Interaction of Anisotropic Beam Electrons in Electromagnetic Vlasov Simulations
ANJAN PAUL and DEVENDRA SHARMA
Physics of Plasmas, 30, 102104, October 2023

Development of Prototype Power Supply for Ohmic Transformer System of SSST
URMIL THAKER, VAIBHAV RANJAN, SUPRIYA A. NAIR
Fusion Engineering and Design, 196, 114016, November 2023

Unprecedented Confinement Time of Electron Plasmas with a Purely Toroidal Magnetic Field in SMARTEX-C
LAVKESH LACHHVANI, SAMBARAN PAHARI, RAJIV GOSWAMI, YOGESH G. YEOLE, MINSHA SHAH, NIKHIL MOHURLE and PRABAL K. CHATTOPADHYAY
Scientific Reports, 13, 19038, November 2023

Simplicial Network Analysis on EEG Signals
K. SUDHAMAYEE, M. GOPAL KRISHNA, P. MANIMARAN
Physica A: Statistical Mechanics and its Applications, 630, 129230, November 2023

Laser-Cluster Interaction in an External Magnetic Field: Emergence of a Nearly Monoenergetic Weakly Relativistic Electron Beam
KALYANI SWAIN, S. S. MAHALIK, and M. KUNDU
Physical Review A, 108, 53104, November 2023

Trapping of Agglomerated Nanoparticles by the Acoustic Field: Influence of Particle Diameter and Density on the Trap Efficiency
SATYA P R KANDADA and C BALASUBRAMANIAN
Pramana - Journal of Physics, 97, 195, November 2023

Overview of the Experimental Helium Cooling (EHCL) System
B.K. YADAV, A. GANDHI, A. SARASWAT, S. VERMA, P. CHAUDHURI
Fusion Engineering and Design, 196, 114006, November 2023

Spatio-Temporal Dynamics of Anisotropic Emission from Nano-Second Laser Produced Aluminium Plasma
B. R. GEETHIKA, JINTO THOMAS, MILAAN PATEL, RENJITH KUMAR R. and HEM

CHANDRA JOSHI
Journal of Analytical Atomic Spectrometry, 38, 2477, November 2023

Investigation of EDF Evolution and Charged Particle Transport in E × B Plasma Based Negative Ion Sources Using Kinetic Simulations
MIRAL SHAH, BHASKAR CHAUDHURY and MAINAK BANDYOPADHYAY
Scientific Reports, 13, 20044, November 2023

Study on Structural Properties of Swift Heavy Ion Induced Damage in Al2O3
PARAMITA PATRA, SEJAL SHAH, S.K. KEDIA, I. SULANIA and M.J. SINGH
Radiation Physics and Chemistry, 212, 111128, November 2023

De-Noising of Microwave Reflectometry Signal Using Maximal Overlap Discrete Wavelet Packet Transform for Plasma Density Measurement
SUBRAMANIYAN N., J.J.U. BUCH, A. AMALIN PRINCE, SURYA PATHAK
Measurement, 222, 113564, November 2023

Effect of Flow Shear on the Onset of Dynamos
SHISHIR BISWAS and RAJARAMAN GANESH
Physics of Plasmas, 30, 112902, November 2023

Dielectric Relaxation Behavior and Electrical Conduction Mechanism of PVA/ZnO Nanocomposites for Flexible Electronic Device Application
TOIJAM SUMA CHANU, KSHETRIMAYUM JUGESHWAR SINGH, WAHENGBAM JOYCHANDRA SINGH, KONGKHAM NOMITA DEVI
Physica Status Solidi A: Applications and Materials Science, 220, 2300531, November 2023

Nonlinear Interaction of Electromagnetic Wave with Electron Acoustic Wave in Plasma
M DUTTA, J GOSWAMI and S S KAUSIK
Physica Scripta, 98, 115614, November 2023

A Staged Approach to Indian DEMO
S.P. DESHPANDE and P.N. MAYA
Nuclear Fusion, 63, 126060, December 2023

Applied Plasma Physics Experiments in Linear (APPEL) Device for Plasma Surface Interaction Studies
Y. PATIL and S.K. KARKARI
Fusion Engineering and Design, 197, 114056, December 2023

Physics Design of 14 MeV Neutron Generator Facility at the Institute for Plasma Research
H L SWAMI, S VALA, M RAJPUT, M ABHANGI, RATNESH KUMAR, A SAXENA and RAJESH KUMAR
Plasma Science and Technology, 25, 125602, December 2023

Effect of Inlet/Outlet Height Difference on P-Q Characteristics of an Electromagnetic Pump for Heavy Liquid Metals
S. SAHU, H. TAILOR, A. PRAJAPATI, S. GUPTA, S. VERMA, R. BHATTACHARYAY
Fusion Engineering and Design, 197, 114051, December 2023

Leaky Mode Analysis of Solid Dielectric Horn Antenna
SHREYA SUDHAKARAN MENON, SHUBHAM KALRA, SURYA KUMAR PATHAK, NALESH SIVANANDAN, SUPRIYA M. HARIHARAN
Progress in Electromagnetics Research M, 121, 95, 2023

Terahertz Field Generation from Laser Interaction

with Spherical Nano-Particles: Effect of External Magnetic Field
A. P. SINGH, K. GOPAL, Y. GOSWAMI, M. KUNDU and P. VARSHNEY
Optical and Quantum Electronics, 56, 199, December 2023

Magnetic Domain Structure and Magneto-Transport Properties of Laser Ablated Co40Fe40B20 Thin Films
G VENKAT SWAMY, P K ROUT, HIMANSHU PANDEY, B RISCOB and G A BASHEED
Nano Express, 4, 45002, December 2023

A Simple Study for an Optimized Operation of the ITER Cryodistribution Cold Rotating Machines
HYUN-SIK CHANG, HITENSINH VAGHELA, DAVID GRILLOT, PRATIK PATEL and NITIN SHAH
Cryogenics, 136, 103760, December 2023

Effect of Annealing Temperature on the Structure and Optical Properties of ZnO Thin Films
NIMITHA K VIJAY, P N MAYA, S MUKHERJEE, M O LIEDKE, M BUTTERLING, A G ATTALLAH, E HIRSCHMANN, A WAGNER, M D BENOY
Journal of Physics: Condensed Matter, 36, 135002, December 2023

Experimental Investigation of a Triple Point in a Dusty Plasma
SWARNIMA SINGH, P. BANDYOPADHYAY, KRISHAN KUMAR, and A. SEN
Physics of Plasmas, 30, 123701, December 2023

Study of Ohmic Breakdown and Burnthrough Phase of ADITYA Tokamak S. PATEL, R. L. TANNA, M. B. CHOWDHURI, K. A. JADEJA, K. M. PATEL, P. K. CHATTOPADHYAY, V. SHARMA, R. MANCHANDA, N. RAMAIYA, H. RAJ, M. M. MAKWANA, K. S. SHAH, U. C. NAGORA, S. B. BHATT, Y. C. SAXENA, K. B. K. MAYYA, and J. GHOSH
Physics of Plasmas, 30, 122505, December 2023

Shivalik Plasma Device-I, A Glow Discharge Device to Study the Collective Dynamics of Dusty Plasma
SACHIN SHARMA, MEENAKSHEE SHARMA, G. VEDA PRAKASH, PRABHAKAR SRIVASTAV, YOGESH SAXENA, SAYAK BOSE, and SANAT TIWARI
AIP Advances, 13, 125110, December 2023

Study of a Collisionless Magnetized Plasma Sheath with Nonextensively Distributed Species
R PAUL, K DEKA, G SHARMA, R MOULICK, S ADHIKARI, S S KAUSIK, B K SAIKIA
Plasma Science and Technology, 25, 125001, December 2023

The Development of a Novel Apparatus to Measure the Emissivity of High-Roughness Materials at 82 K
AVIJIT DEWASI, RANJANA GANGRADEY, SAMIRAN SHANTI MUKHERJEE, VISHAL GUPTA, ROHAN DUTTA, ABHINAV B DESAI, JYOTI S MISHRA, PARESH PANCHAL, PRATIK A NAYAK and HEMANG S AGRAVAT
Measurement Science and Technology, 34, 125908, December 2023

Graded Oxide Layer for High-Performing Nanosized Synaptic Emulator
SUDHEER, RUPAM MANDAL, VIVEK PACHCHIGAR, SOORAJ KP, BISWARUP SATPATI, TAPOBRATA SOM, MUKESH RANJAN
Applied Surface Science, 639, 158115, December 2023

High Temperature Vacuum Brazing of Tungsten to Tungsten Alloy with Structural Material
K. PREMJIT SINGH, ALPESH PATEL, KEDAR BHOPE, SANDEEP RIMZA, MAYUR MEHTA , S.S. KHIRWADKAR
Fusion Engineering and Design, 197, 114058, December 2023

Penicillin Antibiotic (Ampicillin and Cloxacillin) Degradation Using Non-thermal Pencil Plasma Jet
VIKAS RATHORE, AKANKSHA PANDEY, SHRUTI PATEL, JIGNASA SAVJANI, SHITAL BUTANI, HEMAN DAVE and SUDHIR KUMAR NEMA
Water, Air, & Soil Pollution, 235, 44, December 2023

Development of Liquid Stub Tuner and Liquid Phase Shifter for Antenna-Plasma Impedance Matching for High Power RF Experiments
RAJ SINGH, VISHANT GAHLAUT, JOYDEEP GHOSH, VARUN, MUMTAZ A ANSARI, AMARDAS ALLI and P K ATREY
Asian Journal of Physics, 32, 583, September - December 2023

Review of Cockcroft-Walton High Voltage Low Current DC Power Supplies
URMIL THAKER and SANTOSH C. VORA
Power Research - A Journal of CPRI, 19, 217, December 2023

Complex Dielectric and Impedance Analysis in Dy1-XPrXMnO3 Compounds: Partial Substitution Effects
PRATIK LAKHANI, PANKAJ SOLANKI, MAYUR VALA, PARESH SIDDHPURA, DHANANJAY DHRUV, K.P. SOORAJ, J.H. MARKNA and BHARAT KATARIA
Ceramics International, PartB, 50, 3351, January 2024

Thermal Expansion Studies of Li2TiO3 by Dilatometry and In-Situ High-Temperature X-Ray Diffraction
AROH SHRIVASTAVA, VYOM DESAI, PARITOSH CHAUDHURI Ceramics
International, Part B, 50, 1756, January 2024

Deep Learning Assisted Microwave-Plasma Interaction Based Technique for Plasma Density Estimation
PRATIK GHOSH, BHASKAR CHAUDHURY, SHISHIR PUROHIT, VISHV JOSHI, ASHRAY KOTHARI and DEVDEEP SHETRANJIWALA
Journal of Physics D: Applied Physics, 57, 14001, January 2024

Global Gyrokinetic Simulations of Electrostatic Microturbulent Transport in LHD Stellarator with Boron Impurity
TAJINDER SINGH, JAVIER H. NICOLAU, FEDERICO NESPOLI, GEN MOTOJIMA, ZHIHONG LIN, ABHIJIT SEN, SARVESHWAR SHARMA and ANIMESH KULEY
Nuclear Fusion, 64, 016007, January 2024

Experiences and Lessons Learned during Manufacturing of Group-Y Cryolines for ITER
H. KAPOOR, K. CHOUKEKAR, N. SHAH, V. GAUR, B. DASH, U. KUMAR, A. GARG, S. MADEENAVALLI, M. JADON, J. FOURNIER, H. VAGHELA, D. GRILLOT, B. SARKAR, Y. SARVAIYA, B. JOSHI, S. GAJERA, A. SISODIYA
Cryogenics, 137, 103779, January 2024

Laser Beat-Wave Interaction with Electron–Hole Plasmas Relevant to Terahertz Field Generation
A. P. SINGH, K. GOPAL, D. N. GUPTA, M. KUNDU and P. VARSHNEY
Indian Journal of Physics, 98, 383, January 2024

Plasma Sterilization for Bacterial Inactivation: Studies on Probable Mechanisms and Biochemical Actions
TEJAL BARKHADE, KUSHAGRA NIGAM, G. RAVI, SEEMA RAWAT and S. K. NEMA
Plasma Chemistry and Plasma Processing, 44, 429, January 2024

Influence of In-Situ Substrate Temperature on Anisotropic Behaviour of Glancing Angle Grown Nickel Nanocolumns
RAJNARAYAN DE, S. AUGUSTINE, B. DAS, M. K. SIKDAR, M. RANJAN, P. K. SAHOO, S. MAIDUL HAQUE, C. PRATHAP & K. DIVAKAR RAO
Applied Physics A: Materials Science and Processing, 130, 126, January 2024

Energy Calibration of Silicon Drift Detector - Based Spectrometer at ADITYA-U
S PUROHIT, Y TAUNK, M K GUPTA and K GARG
Physica Scripta, 99, 015607, January 2024

A CFD Analysis of the Rotating Target Holder of the 14-MeV neutron generator
SNEHAL JAYSWAL, MANOJ KUMAR GUPTA, SUDHIRSINH VALA, RATNESH KUMAR, RAJESH KUMAR
Fusion Engineering and Design, 198, 114081, January 2024

Review on Laser-Induced Breakdown Spectroscopy: Methodology and Technical Developments
JINTO THOMAS and HEM CHANDRA JOSHI
Applied Spectroscopy Reviews, 59, 124, January 2024

Long Plasma Duration Operation Analyses with an International Multi-Machine (Tokamaks and Stellarators) Database
X. LITAUDON, H.-S. BOSCH, T. MORISAKI, M. BARBARINO, A. BOCK, E. BELONOHY, S. BREZINSEK, J. BUCALOSSI, S. CODA, R. DANIEL, A. EKEDAHL, K. HANADA, C. HOLCOMB, J. HUANG, S. IDE, M. JAKUBOWSKI, B. V. KUTEEV, E. LERCHE,, T. LUCE, P. MAGET, Y. SONG, J. STOBER, D. VAN HOUTTE, Y. XI, L. XUE, S. YOON, B. ZHANG and JET CONTRIBUTORS
Nuclear Fusion, 64, 015001, January 2024

Degradation of Methylene Blue through Atmospheric Pressure Glow Discharge Plasma Treatment
FLOSSIE B F CH MARAK, W JOYCHANDRA SINGH, DEEPJYOTI MAHANTA, NIBEDITA KAPIL, PROBIN PHANJOM, HEROJIT SINGH LOUSHAMBAM, SMRUTI R MOHANTY and NGANGOM AOMOA
Physica Scripta, 99, 015601, January 2024

Development of Lead Lithium (Pb-16Li) Alloy Production System and Characterization of the Produced Alloy
A. DEOGHAR, A. PRAJAPATI, S. VERMA, A. SARASWAT, S. GUPTA, D. SHARMA, N. KUMAR, C.SASMAL, V.VASAVA, H.TAILOR, R. BHATTACHARYAY
Fusion Engineering and Design, 198, 114072, January 2024

Source Performance Optimization in Cesiated Mode in ROBIN
K. PANDYA, M.J. SINGH, M. BHUYAN, M. BANDYOPADHYAY, H. TYAGI, V. MAHESH, A. GAHLAUT, K. PATEL, R.K. YADAV, S. SHAH, B. PRAJAPATI, H. MISTRI and A. CHAKRABORTY
Journal of Instrumentation, 19, C02020, February 2024

A Harmonic Study of Electric Field Nonlinearity and Field Reversal in Collisionless Capacitive Discharges Driven By Sawtooth-Like Waveforms
SARVESHWAR SHARMA, NISHANT SIRSE, MILES M TURNER, ANIMESH KULEY
Physics Letters A, 498, 129346, February 2024

Mechanical and Electrical Performance of Glass Fiber Reinforced Plastic Insulation for Cryogenic Application in Fusion Magnet Irradiated in Fast Breeder Reactor
RAJIV SHARMA, V.L. TANNA, MITUL ABHANGI, H.L. SWAMI, E. RADHA, G. RAGHU KUMAR, KV SURESH, ALKESH M MAVANI
Fusion Engineering and Design, 199, 114148, February 2024

Neutron Irradiation Impact on Structural and Electrical Properties of Polycrystalline Al2O3
SUNIL KUMAR, SEJAL SHAH, S. VALA, M. ABHANGI, A. CHAKRABORTY
Nuclear Engineering and Technology, 56, 402, February 2024

Turbulent Spot Formation in Stably Stratified Three-Dimensional Yukawa Liquids
SURUJ KALITA, RAJARAMAN GANESH
Physical Review Research, 6, 13197, February 2024

Excitation of Cylindrical and Spherical Precursor Solitons in A Flowing Dusty Plasma: Experimental and Simulation Studies
KRISHAN KUMAR, P. BANDYOPADHYAY, SWARNIMA SINGH, A. SEN
Physics of Plasmas, 31, 23705, February 2024

Observation of Non-Planar Dust Acoustic Solitary Wave in A Strongly Coupled Dusty Plasma
PRARTHANA GOGOI, BIDYUT CHUTIA, PARAGJYOTI SUT, YOSHIKO BAILUNG, NIRAB C. ADHIKARY
Physics of Plasmas, 31, 23706, February 2024

Low Emissivity Thin Film Coating on Glass Fiber Reinforced Plastic Used For Cryogenic Application
UDAY KUMAR, HITENSINH B. VAGHELA, AARJUMATHEWKOSHY and PARASURAMAN SWAMINATHAN
Journal of Materials Science: Materials in Electronics, 35, 474, February 2024

Investigation of Developed Liquid Stub Tuner for the Antenna Impedance Matching For High-Power RF Plasma Experiments
RAJ SINGH, VARUN, VISHANT GAHLAUT, JOYDEEP GHOSH, PRABHAKAR TRIPATHI, HANSRAJ KACHHAWA, UTTAM KUMAR GOSWAMI, V. P. ANITHA
IEEE Transactions on Plasma Science, 52, 521, February 2024

Ion Temperature Dynamics for the Edge and Scrape-Off Layer Plasma Turbulence: Role of Gyro-Viscosity and Vorticity
N BISAI
Physica Scripta, 99, 025616, February 2024

Pseudo-spectral solver versus grid-based solver: A quantitative accuracy test using GMHD3D and PLUTO4.4
SHISHIR BISWAS, RAJARAMAN GANESH
Computers and Fluids, 272, 106207, March 2024

Swift Heavy Ion Irradiation Effects on Tungsten Carbide Films
SHRISTI BIST, PARSWAJIT KALITA, SEJAL SHAH, NEHA SINGH, RAJEEV GUPTA, INDRA SULANIA, UDAI B. SINGH, AMIT K. CHAWLA, AMBUJ MISHRA, RATNESH K.

PANDEY, D.K. AVASTHI
Journal of Alloys and Compounds, 976, 173201, March 2024

Wideband Frequency Reconfigurable Plasma Antenna Launched By Surface Wave Coupler
MANISHA JHA, NISHA PANGHAL, AJAY K. PANDEY, UNNATI PATEL, RAJESH KUMAR, SURYA K. PATHAK
AEU - International Journal of Electronics and Communications, 176, 155113, March 2024

Unconventional Apparatuses and Diagnostic Techniques for Studying Negative Ion Plasmas in Laboratory Devices
SHANTANU KUMAR KARKARI
Reviews of Modern Plasma Physics, 8, s41614-024-00146-7, March 2024

Degradation of Dyes Using Reactive Species of Atmospheric Pressure Dielectric Barrier Discharge Formed By a Pencil Plasma Jet
VIKAS RATHORE, AKANKSHA PANDEY, SHRUTI PATEL, HEMAN DAVE and SUDHIR KUMAR NEMA
Physica Scripta, 99, 035602, March 2024

Numerical Analysis of a Steady-State and Transient Performance Using a Tube-In-Tube Heat Exchanger Unit for Cryogenic Process Simulator
VINIT SHUKLA, AAFAQ ALAM, NITIN SHAH, HITENSINH VAGHELA, PARTHASARATHI GHOSH
Cryogenics, 138, 103801, March 2024

Investigation of Impulse Voltage Test of Ohmic Coil System in ADITYA-U Tokamak
ROHIT KUMAR, HARSHITA RAJ, R.L. TANNA, TANMAY MACWAN, S. AICH, J. GHOSH
Fusion Engineering and Design, 200, 114203, March 2024

Control In Corrosive Behaviour of Stainless Steel (SS304) Surfaces by Enabling It as Superhydrophobic Using One-Dimensional Micro-Groove Textured Surfaces
K. SURESHVARR, R. KANNAN, M. UDHAYAKUMAR, B. BASKAR, LUCKACHAN K. GEORGE, JOSEPH ALPHONSA and P. SIVASHANMUGAM
Journal of Bio- and Tribo-Corrosion, 10, 28, March 2024

Cold Atmospheric Plasma (CAP) Treatment Increased Reactive Oxygen and Nitrogen Species (RONS) Levels in Tumor Samples Obtained From Patients with Low-Grade Glioma
YOGESH AGGARWAL, AKSHAY VAID, ANAND VISANI, RAMKRISHNA RANE, ALPHONSA JOSEPH, SUBROTO MUKHERJEE, MANJARI TRIPATHI, P SARAT CHANDRA, RAMESH DODDAMANI, APARNA BANERJEE DIXIT and JYOTIRMOY BANERJEE
Biomedical Physics & Engineering Express, 10, 025018, March 2024

Development and performance evaluation of Sr2CeO4 - SrCe0.85Y0.15O3-δ based electrochemical hydrogen isotopes sensor
DEEPAK YADAV, AROH SHRIVASTAVA, AMIT SIRCAR, PRAGNESH DHORAJIYA, AMIT MUNIYA, RAJENDRA PRASAD BHATTACHARYAY
Fusion Engineering and Design, 200, 114189, March 2024

Observation of Turbulence-Induced Reduced Electrostatic Particle Flux in the Presence of QL Whistlers in Large Laboratory Plasma
A. K. SANYASI, PRABHAKAR SRIVASTAV, L. M. AWASTHI, P. K. SRIVASTAVA, R. SUGANDHI

Physics of Plasmas, 31, 032119, March 2024

Kinetic Instability of Whistlers in Electron Beam-Plasma Systems
ANJAN PAUL, DEVENDRA SHARMA
Physics of Plasmas, 31, 032117, March 2024

Nonlinear Dispersion Relation of Dust Acoustic Waves using the Korteweg–De Vries Model
FARIDA BATOOL, AJAZ MIR, SANAT TIWARI, ABHIJIT SEN
Physics of Plasmas, 31, 034502, March 2024

D.1.2 Conference Papers

Porous Media Approach in Hydraulic Performance Evaluation of Cable-in-Conduit Conductor in Superconducting Magnet Applications
HITENSINH VAGHELA, VIKAS LAKHERA and BISWANATH SARKAR
Fluid Mechanics and Fluid Power: Select Proceedings of FMFP 2021, Lecture Notes in ***Mechanical Engineering, 3, pp 503-508, April 2023. ISBN: 978-981-19-6269-1***

Optimization of Circulation Power in First Wall of Breeding Blanket Using He-CO2 Gas Mixture as a Replacement of Helium
ANKIT GANDHI, DEEPAK SHARMA, NIMESH GAJJAR and PARITOSH CHAUDHRI
Advances in Clean Energy and Sustainability: Proceedings of ICAER 2022, pp 679-688, May 2023. ISBN: 978-981-99-2278-9

An Experimental Investigation on the Effect of Adding Nanoparticles to Seawater in Rapid Cooling System
LATEFA ALHASSAN, SHIKHA EBRAHIM, SAYANTAN MUKHERJEE, NASER ALI, EMIL PRADEEP
Proceedings of the 8th Thermal and Fluids Engineering Conference (TFEC), 1499-1509, May 2023

Streaming Positron Beam Effect on Relativistic Multicomponent Dusty Plasma
BIRBAISHRI BORO, NIRAB C. ADHIKARY; APUL N. DEV and BIPUL K. SAIKIA
AIP Conference Proceedings, 2819, 070002, June 2023

Simulation and Implementation of a 350kV, 50mA High Voltage DC Generator for Particle Accelerator Applications
AMAL S, POOJA JOSHI, ASHOK MANKANI, ARITRA CHAKRABORTY, PAUL D. CHRISTIAN, SAURABH KUMAR and UJJWAL BARUAH
2023 International Conference on Power, Instrumentation, Control and Computing, PICC 2023, 23243695, June 2023

Measurement of 85Rb(n, 2n)84mRb Reaction Cross-Section at 15.72±0.59 and 16.73±0.66 MeV
N. L. SINGH, P. BANGOTRA, MAYUR MEHTA, RATANKUMAR SINGH, B. SONI, R. MAKWANA, RAKESH CHAUHAN, V. VASHI, R. PALIT, P.V. SUBHASH, H. NAIK, S.V. SURYANARAYANA, S.C. SHARMA, KAREL KATOVSKY and JAN VARMUZA
23rd International Scientific Conference on Electric Power Engineering (EPE), 23352052, June 2023

Plasma Techniques for the Fabrication of Hydrophobic Substrates
SMILE KATARIA, SHUBHAM JAIN, BASANT SINGH SIKARWAR and MUKESH RANJAN
Recent Advances in Mechanical Engineering: Select Proceedings of FLAME 2022, Lecture Notes in Mechanical Engineering, 53, pp 831-846, June 2023. ISBN: 978-981-99-1893-5

Progress on ITER Prototype RF Source and Associated Components
RAJESH G. TRIVEDI, RAGHURAJ SINGH, KUMAR RAJNISH; AKHIL JHA, MANOJ PATEL, APARAJITA MUKHERJEE, PALLIWAR AJESH, ROHIT ANAND, SUNIL DANI, DIPAL SONI, SRIPRAKASH VERMA, GAJENDRA SUTHAR,
KARTIK MOHAN, ROHIT AGARWAL, HRUSHIKESH DALICHA, PARESH VASAVA, ULHAS DETHE
AIP Conference Proceedings, 2984, 30013, August 2023

Computational Modeling of Noisy Plasma Images Applicable to Tokamak Imaging Diagnostics for Visible and X-Ray Emissions
DHRUVIL BHATT, KIRTAN DELWADIA, SHISHIR PUROHIT and BHASKAR CHAUDHURY
Proceedings of the Ninth International Conference on Mathematics and Computing, Lecture ***Notes in Networks and Systems, 697, 171, August 2023***

Preliminary Simulation and Experimental Studies on View Dump Made of Silicon Carbide for Vertical Electron Cyclotron Emission Experiment
PRABHAKAR TRIPATHI, VARSHA SIJU, ABHISHEK SINHA, and SURYA K PATHAK
2023 IEEE Wireless Antenna and Microwave Symposium (WAMS), 23706968, September 2023

4-Port Extended Ultrawideband MIMO/Diversity Antenna for Indoor and Outdoor Wireless Communication
ROHIT MATHUR, SANTANU DWARI
2023 IEEE Wireless Antenna and Microwave Symposium (WAMS), Ahmedabad, 7-10 June 2023 (Published in September 2023)

Plasma Sources and Diagnostic Solution for Investigating Laboratory Plasmas
SHANTANU K. KARKARI, Y. PATIL, AVNISH K. PANDEY, S. DAS, PAWANDEEP SINGH, SWATI DAHIYA, N. SIRSE
2023 International Conference on Electromagnetics in Advanced Applications (ICEAA), Venice, Italy, pp. 128-128, 9-13 October 2023

Experimental Investigation of Orbital Debris Soliton Generation
BILL AMATUCCI, ERIK TEJERO, AMI DUBOIS, LON ENLOE, D. BLACKWELL, C. CRABTREE, G. GANGULI, A. SEN
2023 International Conference on Electromagnetics in Advanced Applications (ICEAA), Venice, Italy, pp. 496-496, 9-13 October 2023

Wideband Compact Substrate Integrated Waveguide Slot Antenna
KUNDAN KUMAR, SHRUTI PRIYA, SWAPNIL SHEKHAR, SANTANU DWARI
35th General Assembly and Scientific Symposium of the International Union of Radio Science (URSI GASS), Sapporo, Japan, pp. 1-4, October 2023

Analysis of Microwave Reflectometry Data Using Empirical Mode Decomposition for Beat Frequency Estimation
SUBRAMANIYAN N, BUCH J J U, A AMALIN PRINCE, SURYA PATHAK
2023 IEEE Industrial Electronics and Applications Conference (IEACon), Penang, Malaysia, pp. 7-12, 6-7 November 2023

Initial Effects of Plasma Treatment on Maize Seeds: A Laboratory Study
KUNDAN VILIYA, UTTAM SHARMA, MANISHA THAKUR, JAYSHREE SHARMA, K

N GURUPRASAD, R RANE and J GHOSH
Journal of Physics: Conference Series, 2603, 012050, November 2023

Amorphous Silica Coating on Carbon Fiber by Bipolar Pulsed RF-PECVD: A Step towards Advanced Composites
SUMIT KUMAR, BRIJESH PRASAD, RAHUL PILLAI, C. JARIWALA, I. C. LEKSHMI, K. KUMAR, V. YUGESH
AIP Conference Proceedings, 2978, 020011, January 2024

Rapid Scanning Polarizing Martin Puplett type THz Fourier Transform Spectrometer (FTS) for ITER ECE Measurements
RAVINDER KUMAR, SUMAN DANANI, J J CHAUDHARI, HITESH B PANDYA
2023 IEEE Microwaves, Antennas, and Propagation Conference (MAPCON), pp. 1-5, March 2024

Digital Video Communication Using Salt Water Standing Columns
A. SARADA SREE, HITESH CHUDASMA, RAJANBABU AND RAJESH KUMAR
2023 IEEE Microwaves, Antennas, and Propagation Conference (MAPCON), pp. 1-6, March 2024

Numerical Computation of Electric Field Distribution for HVDC Systems at R&D Facilities
Aritra Chakraborty, S. Amal, Saurabh Kumar, Paul D. Christian, Aditya Naugraiya, Ashok Mankani & Ujjwal Kumar Baruah
High Voltage-Energy Storage Capacitors and Their Applications: Proceedings of HV-ESCA 2023, (Lecture Notes in Electrical Engineering; Vol 1143), pp 207–218, Springer, March 2024. ISBN: 978-981-97-0336-4

Hydrogen Plasma Stream Heat Source from Pulsed Plasma Accelerator at CPPIPR
A. AHMED, S. SINGHA, N. K. NEOG and T. K. BORTHAKUR
High Voltage-Energy Storage Capacitors and Their Applications: Proceedings of HV-ESCA 2023, (Lecture Notes in Electrical Engineering; Vol 1143), pp 39-47, Springer, March 2024. ISBN: 978-981-97-0336-4

A Simulation Analysis of 30 kV / 5A DC Power Supply for Neutral Beam Injectors
ADITYA NAUGRAIYA, ARITRA CHAKRABORTY, KUMAR SAURABH, ASHOK MANKANI
2024 Third International Conference on Power, Control and Computing Technologies (ICPC2T), Raipur, pp. 77-82, March 2024

D.1.3 Book Chapters

Synthesis and Applications of Graphane
RAJASHREE SAHOO, PARITOSH CHAUDHURI and ARPAN KUMAR NAYAK
Nanocarbon Allotropes Beyond Graphene: Synthesis, properties and applications, Pages 5-1 to 5-15, June 2023. ISBN: 978-0-7503-5175-1

Plasma Functionalized Wettability Gradient Surfaces for Electronic Cooling
VISHAKHA BAGHEL, VIVEK PACHCHIGAR, MUKESH RANJAN and BASANT SINGH SIKARWAR
Advances in Fluid and Thermal Engineering: FLAME 2022, Lecture Notes in Mechanical Engineering, Springer, July 2023. ISBN: 978-981-99-2381-6

Quantum Dots and Nanoparticles in Light-Emitting Diodes and Displays Applications
VISHNU CHAUHAN, YOGENDRA KUMAR,

DEEPIKA GUPTA, ANITA SHARMA, DEEPIKA, SONICA UPADHYAY and RAJESH KUMAR
Advanced Materials for Solid State Lighting, Part of the Progress in Optical Science and Photonics Book Series, 25, 253, July 2023. ISBN 978-981-99-4144-5

Applications of Plasma in Metallurgy and Vice-Versa: Indian Context
ALPHONSA JOSEPH, SUDHIR K NEMA, AMIT SIRCAR, PARITOSH CHAUDHARI, UPENDRA PRASAD, SAMIR KHIRWADKAR, and NIRAV JAMNAPARA
Indian Metallurgy: The Platinum Years, Indian Institute of Metals Series, Springer, pp 281–295, November 2023. ISBN: 9789819950591

Electrically Insulating Corrosion-Resistant Tritium Permeation Barrier Coatings for High Temperature Liquid Metal Breeders of Nuclear Fusion Reactors
ABHISHEK SARASWAT, CHANDRASEKHAR SASMAL, ASHOKKUMAR PRAJAPATI, RAJENDRAPRASAD BHATTACHARYAY, PARITOSH CHAUDHURI and SATEESH GEDUPUDI
Coatings for High-Temperature Environments, Springer, pp 351-384, December 2023. ISBN: 978-3-031-45533-9

D.2 INTERNAL RESEARCH AND TECHNICAL REPORTS

D.2.1 Research Reports

PRELIMINARY ENGINEERING DESIGN OF VACUUM THERMAL SHIELDED Pb-Li LOOP SECTION FOR POTENTIAL NUCLEAR FUSION APPLICATION
P. A. RAYJADA, V. MEHTA, P. BAWANKAR, S. RANJITH KUMAR, A. PATEL and R. BHATTACHARYAY
IPR/RR-1511/2023 APRIL 2023

STRUCTURAL CHARACTERIZATION OF DUAL LAYER FORMED AFTER PLASMA NITROCARBURIZING OF AISI 304L
JEET VIJAY SAH, ALPHONSA JOSEPH, GHANSHYAM JHALA and SUBROTO MUKHERJEE
IPR/RR-1512/2023 APRIL 2023

ENHANCEMENT OF SHELF LIFE OF CITRUS LIMON L. (LEMON) USING PLASMA ACTIVATED WATER
VIKAS RATHORE and SUDHIR KUMAR NEMA
IPR/RR-1513/2023 APRIL 2023

DIGITAL VIDEO COMMUNICATION USING SALT WATER STANDING COLUMNS
A. SARADA SREE, HITESH CHUDASMA, RAJAN BABU and RAJESH KUMAR
IPR/RR-1514/2023 APRIL 2023

A CASE STUDY OF THERMAL MIXING BEHAVIOR OF HOT AND COLD FLUID IN T-JUNCTION WITH/WITHOUT MIXING JETS
SANDEEP RIMZA, PARITOSH CHAUDHURI, BRIJESH KUMAR YADAV and SAYANTAN MUKHERJEE
IPR/RR-1515/2023 APRIL 2023

STOPBAND AND PASSBAND ANALYSIS OF FREQUENCY SELECTIVE SURFACE NOTCH FILTER FOR PLASMA DIAGNOSTIC APPLICATION
JAINAM BELANI, ABHISHEK SINHA, SURYA K PATHAK
IPR/RR-1516/2023 APRIL 2023

LABEL-FREE DETECTION OF ORAL CAVITY CANCER BY MULTIVARIATE ANALYSIS OF SERS SPECTRA OF SALIVA

SEBIN AUGUSTINE, ARTI HOLE, SOORAJ K. P., MAHESH SAINI, PANKAJ CHATURVEDI, MUKESH RANJAN and C. MURALI KRISHNA
IPR/RR-1517/2023 APRIL 2023

SPATIO-TEMPORAL DYNAMICS OF ANISOTROPIC EMISSION FROM NANO SECOND LASER PRODUCED ALUMINIUM PLASMA
GEETHIKA B R, JINTO THOMAS, MILAAN PATEL, RENJITH KUMAR and HEM CHANDRA JOSHI
IPR/RR-1518/2023 APRIL 2023

STUDY OF RADIATION POWER DYNAMICS IN GAS PUFF DISCHARGES IN ADITYA-U TOKAMAK
KUMUDNI TAHILIANI, SURYA KUMAR PATHAK, DEVILAL KUMAWAT, I. SURESH, SAMEER KUMAR, RAJU DANIEL, PRAVEENA KUMARI, MALAY BIKAS CHOWDHURI, UMESH NAGORA, KUMARPAL JADEJA, ROHIT KUMAR, R. K. TANNA, JOYDEEP GHOSH and ADITYA-U TEAM
IPR/RR-1519/2023 APRIL 2023

DEVELOPMENT AND DEMONSTRATION OF THRUST BALANCE OF 300 mN THRUST USING STRAIN GAUGE
NARENDER SINGH, RAMESH KUMAR BUDDU, PRAMILA, P.K. SRIVASTAVA, RENU BAHL, MARIAMMAL M., MRITUNJAY KUMAR and P. K. CHATTOPADHYAY
IPR/RR-1520/2023 APRIL 2023

ANALYTICAL DESIGN OF HIGH-PRESSURE RATIO TURBOEXPANDER IMPELLER AND NOZZLE FOR HELIUM LIQUEFACTION PLANT
UJJWAL KUMAR, MANOJ KUMAR GUPTA, ANANTA KR. SAHU and SUSHIL KUMAR RATHORE
IPR/RR-1521/2023 MAY 2023

DESIGN VALIDATION OF VACUUM CHAMBER ASSEMBLY FOR PLASMA THRUSTER EXPERIMENT BY FINITE ELEMENT ANALYSIS METHOD
M. KUMAR, RAMESH KUMAR BUDDU, NARENDER SINGH, RENU BAHL and P.K.CHATTOPADHYAY
IPR/RR-1522/202 MAY 2023

PHOTOCATALYTIC DYE DEGRADATION USING BALL MILLED ZnO AS CATALYST
RAJASHREE SAHOO, PARITOSH CHAUDHURI and HEM CHANDRA JOSHI
IPR/RR-1523/2023 MAY 2023

ESTIMATION OF RADIAL PROFILE OF PARTICLE FLUX FROM H_α EMISSIVITY PROFILE IN ADITYA TOKAMAK
RITU DEY, JOYDEEP GHOSH, M. B. CHOWDHURI, TANMAY M. MACWAN, P. K. ATREY, R. MANCHANDA, N. YADAVA and R. L. TANNA
IPR/RR-1524/2023 MAY 2023

DESIGN AND DEVELOPMENT OF INTERMEDIATE FREQUENCY CIRCUIT FOR REFLECTOMETRY DIAGNOSTIC
VISHNU CHAUDHARY, JJU BUCH, ROHIT MATHUR and S. K. PATHAK
IPR/RR-1525/2023 MAY 2023

SHIELDED IONISATION DISCHARGE (SID) PROBE FOR SPATIO-TEMPORAL PROFILING OF PULSED MOLECULAR BEAM
MILAAN PATEL, JINTO THOMAS and HEM CHANDRA JOSHI
IPR/RR-1526/2023 MAY 2023

HIGH TEMPERATURE VACUUM BRAZING OF TUNGSTEN TO TUNGSTEN ALLOY WITH STRUCTURAL MATERIAL
K. P SINGH, ALPESH PATEL, KEDAR BHOPE, SANDEEP RIMZA, MAYUR MEHTA, S.S KHIRWADKAR
IPR/RR-1527/2023 MAY 2023

DISCHARGE CHARACTERISTICS OF A LOW-PRESSURE GEOMETRICALLY ASYMMETRIC CYLINDRICAL CAPACITIVELY COUPLED PLASMA WITH AN AXISYMMETRIC MAGNETIC FIELD
SWATI DAHIYA, PAWANDEEP SINGH, NISHANT SIRSE, SARVESHWAR SHARMA, YASHASHRI PATIL and SHANTANU KUMAR KARKARI
IPR/RR-1528/2023 MAY 2023

INVESTIGATION OF EDF EVOLUTION AND CHARGED PARTICLE TRANSPORT IN EXB PLASMA BASED NEGATIVE ION SOURCES USING KINETIC SIMULATIONS
MIRAL SHAH, BHASKAR CHAUDHURY and MAINAK BANDYOPADHYAY
IPR/RR-1529/2023 MAY 2023

PERTURBED PLANE COUETTE FLOW IN THREE-DIMENSIONAL STABLY STRATIFIED YUKAWA LIQUIDS
SURUJ KALITA and RAJARAMAN GANESH
IPR/RR-1530/2023 MAY 2023

THEORY OF PLASMA BLOB FORMATION AND ITS NUMERICAL AND EXPERIMENTAL VALIDATIONS
N. BISAI and A. SEN
IPR/RR-1531/2023 MAY 2023

BENCHMARKING OF MINIMUM COLUMN VOLUME DESIGN METHOD FOR RECOVERY OF ^{99}Mo FROM LEU URANY SULPHATE SOLUTION
SHAHRUKH BAREJIA, S JAKHAR, MANIKA SHARMA
IPR/RR-1532/2023 JUNE 2023

ROLE OF TRANSLATIONAL NOISE ON CURRENT REVERSALS OF ACTIVE PARTICLES ON RATCHET
ANSHIKA CHUGH, RAJARAMAN GANESH
IPR/RR-1533/2023 JUNE 2023

ELECTRON TEMPERATURE GRADIENT (ETG) TURBULENCE: A REALIZATION IN LABORATORY PLASMA
L. M. AWASTHI, PRABHAKAR SRIVASTAV, S. K. SINGH, A. K. SANYASI, P. K. SRIVASTAVA, RAMESWAR SINGH, R. SUGANDHI, R. SINGH, S. K. MATTOO and P. K. KAW
IPR/RR-1534/2023 JUNE 2023

ANALYSIS OF MICROWAVE REFLECTOMETRY DATA USING EMPIRICAL MODE DECOMPOSITION FOR BEAT FREQUENCY ESTIMATION
N. SUBRAMANIYAN, J. J. U. BUCH, A. AMALIN PRINCE and SURYA KUMAR PATHAK
IPR/RR-1535/2023 JUNE 2023

PHOTOREFRACTIVE PROPERTIES OF Zn AND Fe CO-DOPED $LiNbO_3$ SINGLE CRYSTALS
B. RISCOB, P.K. MISHRA, JINTO THOMAS, SAGAR AGRAWAL and S.K. PATHAK
IPR/RR-1536/2023 JUNE 2023

A STAGED APPROACH TO INDIAN DEMO
S.P. DESHPANDE and P.N. MAYA
IPR/RR-1537/2023 JUNE 2023

MICROSTRUCTURAL AND ANTIBACTERIAL PROPERTIES OF COPPER OXIDE DEPOSITED ON POLYPROPYLENE FABRIC BY MAGNETRON SPUTTERING
INFANT SOLOMON VINOTH, RAMKRISHNA RANE, MAILA PARAMESH, ALPHONSA JOSEPH
IPR/RR-1538/2023 JUNE 2023

AN ANALYTICAL FORMULATION FOR RADIATION CHARACTERISTICS OF LEAKY-WAVE DIELECTRIC LOADED HELIX ANTENNA FOR BEAM SCANNING
A.K. PANDEY, S.K. PATHAK
IPR/RR-1539/2023 JULY 2023

EFFECT OF SECONDARY PHASES CONTROLLED BY PRECURSOR COMPOSITION ON THE EFFICIENCY OF CZTS THIN FILM SOLAR CELL
SAGAR AGRAWAL, DANILO OLIVEIRA DE SOUZA, C BALASUBRAMANIAN, SUBROTO MUKHERJEE
IPR/RR-1540/2023 JULY 2023

CONCEPTUAL DESIGN OF HELIUM COOLED SOLID BREEDER BLANKET FOR A MODERATE SIZED TOKAMAK FUSION REACTOR
PIYUSH PRAJAPATI, SHISHIR DESHPANDE, P.N. MAYA, H.L. SWAMI, DEEPAK SHARMA
IPR/RR-1541/2023 JULY 2023

THERMAL EXPANSION STUDIES OF Li_2TiO_3 BY DILATOMETRY AND IN-SITU HIGHTEMPERATURE X-RAY DIFFRACTION
AROH SHRIVASTAVA, VYOM DESAI, PARITOSH CHAUDHURI
IPR/RR-1542/2023 JULY 2023

EFFECT OF SIZE OF A CIRCULAR TOKAMAK PLASMA ON SELF-MAGNETIC FIELD: A NUMERICAL APPROACH
S. AICH, A. IYER, J. GHOSH
IPR/RR-1543/2023 JULY 2023

PINI ION SOURCE BACK PLATE AND ITS HIGH HEAT FLUX EXPERIMENT
M. R. JANA, TAPAN M. PATEL, U. K. BARUAH, S. M. BELSARE, K. S. BHOPE, B. CHOKSI, N. S. CONTRACTOR, S. S. KHIRWADKAR, M. MEHTA, P. K. MOKARIA, N. P. PATEL, T.H. PATEL, R. SWAMY AND S. TRIPATHI
IPR/RR-1544/2023 JULY 2023

SOLAR PHOTOCATALYTIC DYE DEGRADATION USING ZINC ORTHOTITANATE AS A PHOTOCATALYST
CHINTAN BHALERAO, RAJASHREE SAHOO, AROH SHRIVASTAVA, PARITOSH CHAUDHURI, T.S. RAJARAMAN
IPR/RR-1545/2023 JULY 2023

SPECTROSCOPIC & MICROSCOPIC STUDIES ON INACTIVATION OF STAPHYLOCOCCUS AUREUS AND SALMONELLA ABONY EXPOSED TO DIRECT CURRENT PLASMA
TEJAL BARKHADE, KUSHAGRA NIGAM, G.RAVI, SEEMA RAWAT and S.K NEMA
IPR/RR-1546/2023 JULY 2023

WIDEBAND RECONFIGURABLE PLASMA ANTENNA LAUNCHED BY SURFACE WAVE COUPLER
MANISHA JHA, NISHA PANGHAL, A.K. PANDEY, UNNATI PATEL, RAJESH KUMAR, SURYA K PATHAK
IPR/RR-1547/2023 JULY 2023

EXPERIMENTAL INVESTIGATION OF A TRIPLE POINT IN A DUSTY PLASMA
SWARNIMA SINGH, P. BANDYOPADHYAY,

KRISHAN KUMAR, and A. SEN
IPR/RR-1548/2023 JULY 2023

PSEUDO-SPECTRAL SOLVER VERSUS GRID-BASED SOLVER: A QUANTITATIVE ACCURACY TEST USING GMHD3D AND PLUTO4.4
SHISHIR BISWAS and RAJARAMAN GANESH
IPR/RR-1549/2023 JULY 2023

DEVELOPMENT OF SUPERHYDROPHOBIC PTFE SURFACE USING OXYGEN PLASMA PROCESSING
SHRUTI KUMARI, VIVEK PACHCHIGAR, BASANTA KUMAR PARIDA, SUKRITI HANS, MAHESH SAINI, SOORAJ K. P. , ROYAL CHRISTIAN, and MUKESH RANJAN
IPR/RR-1550/2023 AUGUST 2023

DIRECT MEASUREMENT OF MAGNETIC FIELD WITH LOW DRIFT ERROR USING AN ACTIVE INTEGRATOR FOR ADITYA-U DISCHARGES
SAMEER KUMAR, KUMUDNI ASSUDANI, PRAVEENA KUMARI, SURESH I, SURYA KUMAR PATHAK, RACHNA RAJPAL, ADITYA-U TEAM
IPR/RR-1551/2023 AUGUST 2023

DEVELOPMENT OF LEAD LITHIUM (Pb-16Li) ALLOY PRODUCTION SYSTEM AND CHARACTERIZATION OF THE PRODUCED ALLOY
A. DEOGHAR, A. PRAJAPATI, S. VERMA, A. SARASWAT, S. GUPTA, D. SHARMA, N. KUMAR, C. SASMAL, V. VASAVA, H. TAILOR, R. BHATTACHARYAY
IPR/RR-1552/2023 AUGUST 2023

AN APPARATUS TO MEASURE THERMAL CONDUCTIVITY OF CERAMIC PEBBLE BEDS UNDER UNIAXIAL COMPRESSIVE STRESS
HARSH PATEL, MAULIK PANCHAL, PARITOSH CHAUDHURI
IPR/RR-1553/2023 AUGUST 2023

DE-NOISING OF MICROWAVE REFLECTOMETRY SIGNAL USING MAXIMAL OVERLAP DISCRETE WAVELET PACKET TRANSFORM FOR PLASMA DENSITY MEASUREMENT
SUBRAMANIYAN N, J J U BUCH, AMALIN PRINCE A and SURYA PATHAK
IPR/RR-1554/2023 AUGUST 2023

POSITION ESTIMATION OF CURRENT-CARRYING FILAMENT USING DIFFERENT MAGNETIC SENSORS IN ADITYA-U TOKAMAK
ROHIT KUMAR, HARSHITA RAJ, SUMAN AICH, TANMAY MACWAN, DEVILAL KUMAWAT, S.K JHA, PRAVEENLAL EDAPPALA, KUMARPAL JADEJA, KAUSHAL PATEL, R.L TANNA and J GHOSH
IPR/RR-1555/2023 AUGUST 2023

MANUFACTURING OF HIGH PURITY Cr_2AlC MAX PHASE MATERIAL: SYNTHESIS AND CHARACTERISATION
VYOM DESAIA, AROH SRIVASTAVA, ARUNSINH ZALA, TEJAS PAREKH, SUROJIT GUPTA, N. I. JAMNAPARA
IPR/RR-1556/2023 AUGUST 2023

KINETIC INSTABILITY OF WHISTLERS IN ELECTRON BEAM-PLASMA SYSTEMS
ANJAN PAUL, and DEVENDRA SHARMA
IPR/RR-1557/2023 AUGUST 2023

MECHANICAL AND ELECTRICAL PERFORMANCE OF GLASS FIBER REINFORCED PLASTICS INSULATION FOR

CRYOGENIC APPLICATION IN FUSION MAGNET IRRADIATED IN FAST BREEDER REACTOR
RAJIV SHARMA, V. L. TANNA, MITUL ABHANGI, H.L. SWAMI , E. RADHA, G. RAGHU KUMAR, KV SURESH and ALKESH M MAVANI
IPR/RR-1558/2023 AUGUST 2023

HIGH MHD ACTIVITY INDUCED EXCITATION OF GAM-LIKE MODE IN ADITYA-U TOKAMAK
KAUSHLENDER SINGH, SUMAN DOLUI, BHARAT HEGDE, ASHOK K. KUMAWAT, ANKIT KUMAR, TANMAY MACWAN, HARSHITA RAJ, SHARVIL PATEL, NANDINI YADAVA, ABHA KANIK, KAJAL SHAH, PRAMILA GAUTAM, ROHIT KUMAR, SUMAN AICH, LAXMIKANTA PRADHAN, ANKIT PATEL, KALPESH GALODIYA, DANIEL RAJU, S.K. JHA, K. A. JADEJA, K. M. PATEL, S. N. PANDYA, LAVKESH LACHHVANI, M.B. CHAUDHARY, R.L. TANNA, P. K. CHATTOPADHYAY, R. PAL, Y. C. SAXENA, ABHIJIT SEN, and JOYDEEP GHOSH
IPR/RR-1559/2023 AUGUST 2023

INVESTIGATION OF FACET EVOLUTION ON Si SURFACES BOMBARDED WITH Xe IONS
SUKRITI HANS, BASANTA KUMAR PARIDA, SEBIN AUGUSTINE, VIVEK PACHCHIGAR, SOORAJ K P, MUKESH RANJAN
IPR/RR-1560/2023 AUGUST 2023

EXPERIMENTAL VALIDATION OF THE ANALYTIC MODEL FOR THE TEMPORAL DECAY OF THE DENSITY AUTO-CORRELATION FUNCTION IN A STRONGLY COUPLED DUSTY PLASMA
ANKIT DHAKA, PINTU BANDYOPADHYAY, PV SUBHASH, and A. SEN
IPR/RR-1561/2023 AUGUST 2023

STABILIZATION OF SAWTEETH INSTABILITY BY SHORT GAS PULSE INJECTION IN ADITYA-U TOKAMAK
SUMAN DOLUI, KAUSHLENDER SINGH, TANMAY MACWAN, HARSHITA RAJ, BHARAT HEGDE, PRAVESH DHYANI, ANKIT KUMAR, ASHOK KUMAWAT, K.A JADEJA, J GHOSH, R L TANNA, SUMAN AICH, ROHIT KUMAR, K M PATEL, P. GAUTAM, L. PRADHAN, SHARVIL PATEL, YM NANDINI, A. PATEL, UMESH NAGORA, M.K. GUPTA, M.B. CHOWDHURY, S. PUROHIT, A.N. ADHIYA
IPR/RR-1562/2023 SEPTEMBER 2023

ADVANCEMENT OF LANGMUIR PROBE-BASED LASER PHOTO DETACHMENT TECHNIQUE FOR NEGATIVE ION DENSITY MEASUREMENT IN A HIGH POWER HELICON PLASMA SOURCE
D. MUKHOPADHYAY, M. BANDYOPADHYAY, H. TYAGI, K. PATEL
IPR/RR-1563/2023 SEPTEMBER 2023

EXPERIMENTAL DETERMINATION OF HYDROGEN ISOTOPE DIFFUSIVITY, SOLUBILITY AND PERMEABILITY IN MOLTEN LEAD LITHIUM EUTECTIC ALLOY
SUDHIR RAI, AMIT SIRCAR and R. BHATTACHARYAY
IPR/RR-1564/2023 SEPTEMBER 2023

SYSTEMATIC STUDY OF ELECTRIC FIELD REVERSAL PHENOMENON IN LOW PRESSURE CAPACITIVE DISCHARGES EXCITED BY SAWTOOTH-LIKE WAVEFORM
SARVESHWAR SHARMA, NISHANT SIRSE and ANIMESH KULEY
IPR/RR-1565/2023 SEPTEMBER 2023

EXCITATION OF CYLINDRICAL AND SPHERICAL PRECURSOR SOLITONS IN A FLOWING DUSTY PLASMA: EXPERIMENTAL AND SIMULATION STUDIES
KRISHAN KUMAR, P. BANDYOPADHYAY, SWARNIMA SINGH, and A. SEN
IPR/RR-1566/2023 SEPTEMBER 2023

EFFECT OF THERMAL ELECTRONS INSIDE THE SHEATHS ON THE RESONANCE FREQUENCY OF A DC-BIASED HAIRPIN PROBE
PAWANDEEP SINGH, AVNISH PANDEY, SWATI DAHIYA, YASHASHRI PATIL, NISHANT SIRSE, SHANTANU KARKARI
IPR/RR-1567/2023 SEPTEMBER 2023

FEASIBILITY STUDY OF HTS CURRENT LEADS WITH MgB_2 SHUNT FOR TOKAMAK APPLICATION
NITIN BAIRAGI, VIPUL L. TANNA, HIREN NIMAVAT, DASHRATH SONARA, ATUL GARG, ROHITKUMAR PANCHAL, GAURANG MAHESURIA, RAKESHKUMAR PATEL, DIKENS CHRISTIAN, GAURAV PURWAR, PRADIP PANCHAL, UPENDRA PRASAD, and DANIEL RAJU
IPR/RR-1568/2023 SEPTEMBER 2023

EXPERIMENTAL MEASUREMENT OF SHEATH EDGE ELECTRIC FIELD USING A MICROWAVE HAIRPIN RESONATOR PROBE
PAWANDEEP SINGH, AVNISH PANDEY, SWATI DAHIYA, SHANTANU KARKARI
IPR/RR-1569/2023 OCTOBER 2023

INVESTIGATION OF DEVELOPED LIQUID STUB TUNER FOR THE ANTENNA IMPEDANCE MATCHING FOR HIGH POWER RF PLASMA EXPERIMENTS
RAJ SINGH, VARUN, VISHANT GAHLAUT, JOYDEEP GHOSH, PRABHAKAR TRIPATHI, HANSRAJ KACHHAWA, UTTAM GOSWAMI, and V. P. ANITHA
IPR/RR-1570/2023 OCTOBER 2023

REMOTE HANDLING CONTROL SYSTEM AND OPERATIONS OF VACUUM COMPATIBLE IN-VESSEL INSPECTION SYSTEM
NAVEEN RASTOGI, MANOAH STEPHEN, KRISHAN KUMAR GOTEWAL, RAVI RANJAN KUMAR, JIGNESH CHAUHAN, PRAMIT DUTTA, DILIP RAVAL, YUVAKIRAN P, SIJU GEORGE
IPR/RR-1571/2023 OCTOBER 2023

FABRICATION OF Al6061/Ti_3AlC_2 MAX PHASE SURFACE COMPOSITE BY FRICTION STIR PROCESSING AND INVESTIGATION OF WEAR PROPERTIES
VYOM DESAI, VISHVESH BADHEKA, ARUNSINH ZALA, TEJAS PAREKH, N. I. JAMNAPARA
IPR/RR-1572/2023 OCTOBER 2023

DEVELOPMENT OF LAB-SCALE ATMOSPHERIC MOLECULAR SIEVE BED AND GENERATION OF EXPERIMENTAL BREAK THROUGH CURVES FOR ADSORPTION STUDIES
DEEPAK YADAV, V. GAYATHRI DEVI, PRAGNESH DHORAJIYA, AMIT MUNIA, AMIT SIRCAR, R. BHATTACHARYAY
IPR/RR-1573/2023 OCTOBER 2023

DEVELOPMENT AND PERFORMANCE EVALUATION OF Sr_2CeO_4 - $SrCe_{0.85}Y_{0.15}O_{3-\delta}$ BASED ELECTROCHEMICAL HYDROGEN ISOTOPES SENSOR
DEEPAK YADAV, AROH SHRIVASTAVA, AMIT SIRCAR, PRAGNESH DHORAJIYA,

AMIT MUNIYA and RAJENDRA PRASAD BHATTACHARYAY
IPR/RR-1574/2023 OCTOBER 2023

ION TEMPERATURE DYNAMICS FOR THE EDGE AND SCRAPE-OFF LAYER PLASMA TURBULENCE: ROLE OF GYRO-VISCOSITY AND VORTICITY
N BISAI
IPR/RR-1575/2023 OCTOBER 2023

DESIGN AND ANALYSIS OF MIXED BED SOLID BREEDER BLANKET WITH TITANIUM BERRYLIDE AS NEUTRON MULTIPLIER
DEEPAK SHARMA, PARITOSH CHAUDHURI, H.L SWAMI, MITUL R ABHANGI, S. BHATTACHARYA
IPR/RR-1576/2023 OCTOBER 2023

INVESTIGATION OF THERMAL HYDRAULICS PERFORMANCE OF Pb-Li IN A SQUARE DUCT
SRIKANTA SAHU, ASHOK PRAJAPATI, DUSMANTA MOHANTA, KARISHMA PANDYA, SANDEEP GUPTA and RAJENDRAPRASAD BHATTACHARYAY
IPR/RR-1577/2023 OCTOBER 2023

DECONFINEMENT OF RUNAWAY ELECTRONS BY LOCAL VERTICAL MAGNETIC FIELD PERTURBATION
SOMESWAR DUTTA, DEEPTI SHARMA, R. L. TANNA, J. GHOSH, LT. R. SRINIVASAN and D. RAJU
IPR/RR-1578/2023 NOVEMBER 2023

MEASUREMENT OF COOLING POWER OF HELIUM REFRIGERATOR-CUM-LIQUEFIER PLANT DEVELOPED AT IPR
A. K. SAHU, O. CHANDRATRE, V. PATEL, P. SINGH, H. DAVE, H. KAVAD, R. BHATASANA, N. KUMAR, P. BRAHMBHATT
IPR/RR-1579/2023 NOVEMBER 2023

PRACTICAL PEDAGOGICAL APPROACHES IN HPC FOR OPTIMIZING COMPLEX PROGRAMMING ALGORITHMS: A NUCLEAR FUSION APPLICATION CASE STUDY
SOMESWAR DUTTA, DEEPAK AGGARWAL, DANIEL RAJU
IPR/RR-1580/2023 NOVEMBER 2023

TAILORED PEROVSKITE OXIDE ENGINEERED WITH MULTI-DIMENSIONAL CARBON TO SIMULTANEOUSLY IMPROVE THE ACTIVITY AND STABILITY TOWARDS OXYGEN EVOLUTION REACTION
AMIT K. RANA, AMREEN A. HUSSAIN, SURYAKANT B. GUPTA
IPR/RR-1581/2023 NOVEMBER 2023

ENHANCING HEAT TRANSFER AND ENTROPY GENERATION MINIMIZATION WITH MONO AND HYBRID NANOFLUIDS: AN EXPERIMENTAL STUDY
SAYANTAN MUKHERJEE, SHIKHA EBRAHIM, PURNA CHANDRA MISHRA, PARITOSH CHAUDHURI
IPR/RR-1582/2023 NOVEMBER 2023

PATTERN RECONFIGURABILITY USING PLASMA FOR BEAMSTEERING APPLICATION AT S-BAND
MANISHA JHA, NISHA PANGHAL, RAJESH KUMAR, SURYA K PATHAK
IPR/RR-1583/2023 NOVEMBER 2023

A NOVEL DESIGN OF OHMIC TRANSFORMER POWER SUPPLY (OTPS) FOR SPHERICAL TOKAMAKS
AYUSH, URMIL THAKER, AND SUPRIYA NAIR

IPR/RR-1584/2023 NOVEMBER 2023

A STUDY ON CYCLIC LOADING ANALYSIS OF CERAMIC BREEDER PEBBLE BED FOR FUSION BLANKET
CHIRAG SEDANI, HARSH PATEL, MAULIK PANCHAL, PARITOSH CHAUDHURI
IPR/RR-1585/2023 NOVEMBER 2023

EFFECT OF ELECTRON AND ION MOBILITY ON EDGE BIASING IN TOKAMAK PLASMAS
VIJAY SHANKAR, N. BISAI, SHRISH RAJ, and A. SEN
IPR/RR-1586/2023 NOVEMBER 2023

NEUTRON EMISSION CHARACTERIZATION OF IPR 14 MeV NEUTRON GENERATOR
M. ABHANGI, S. VALA, H. L. SWAMI, RATNESH KUMAR, A. SAXENA AND RAJESH KUMAR
IPR/RR-1587/2023 NOVEMBER 2023

OPTIMIZING THERMO-PHYSICAL PROPERTIES OF Al_2O_3 and TiO_2 NANOFLUIDS: A TAGUCHI - RESPONSE SURFACE METHODOLOGY APPROACH
SAYANTAN MUKHERJEE, AGUS NUGROHO, PURNA CHANDRA MISHRA, PARITOSH CHAUDHURI, MUHAMMAD KOZIN
IPR/RR-1588/2023 DECEMBER 2023

IN-VESSEL INSPECTION SYSTEM: DEVELOPMENT AND TESTING ACTIVITIES OF HIGH VACUUM AND TEMPERATURE TECHNOLOGIES FOR FUSION REMOTE HANDLING
MANOAHSTEPHEN M, NAVEEN RASTOGI, RAVI RANJAN KUMAR, KRISHAN KUMAR GOTEWAL, JIGNESH CHAUHAN, YUVAKIRAN PARAVASTU, DILIP RAVAL, SIJU GEROGE
IPR/RR-1589/2023 DECEMBER 2023

CHARGED PARTICLE DYNAMICS IN AN ELLIPTICALLY POLARIZED ELECTROMAGNETIC WAVE AND A UNIFORM AXIAL MAGNETIC FIELD
SHIVAM KUMAR MISHRA, SARVESHWAR SHARMA, and SUDIP SENGUPTA
IPR/RR-1590/2023 DECEMBER 2023

A COMPREHENSIVE REVIEW OF EXPERIMENTAL AND NUMERICAL STUDIES ON LIQUID METAL-GAS TWO-PHASE FLOWS AND ASSOCIATED MEASUREMENT CHALLENGES
ABHISHEK SARASWAT, ALBERTO FRAILE, SATEESH GEDUPUDI, RAJENDRAPRASAD BHATTACHARYAY and PARITOSH CHAUDHURI
IPR/RR-1591/2023 DECEMBER 2023

FIRST OPERATION OF LLMHD LOOP WITH ELECTROMAGNET FOR R & D MHD EXPERIMENTS
A. PATEL, S. VERMA, A. SARASWAT, P. SATYAMURTHY, S. MALHOTRA, R. BHATTACHARYAY, S. GUPTA, A. PRAJAPATI, M. KUMAR, T. S. RAO, A. MAKWANA, D. SHARMA, A. JAISWAL, D. MOHANTA, S. K. SHARMA, V. VASAVA, H. TAILOR, A. DEOGHAR, S. SAHU, C. DODIYA, U. PRASAD, A. RANJAN and S. RANJITH KUMAR
IPR/RR-1592/2023 DECEMBER 2023

TURBULENT SPOT FORMATION IN THREE-DIMENSIONAL YUKAWA LIQUIDS USING LARGE-SCALE MOLECULAR DYNAMICS SIMULATION - EFFECT OF SYSTEM SIZE
SURUJ KALITA and RAJARAMAN GANESH
IPR/RR-1593/2023 DECEMBER 2023

FRICTION WELDING OF ETP Cu PLATE TO SS304L ROUND BAR: AN EXPERIMENTAL STUDY ON ASYMMETRICAL DISSIMILAR METAL JOINTS
TAPAN PATEL, HARDIK D. VYAS, M. R. JANA, P. CHAUDHURI, U. K. BARUAH
IPR/RR-1594/2023 DECEMBER 2023

MEASUREMENTS OF EFFECTIVE THERMAL CONDUCTIVITY OF LITHIUM METATITANATE PEBBLE BEDS USING TRANSIENT HOT WIRE TECHNIQUE UNDER UNIAXIAL COMPRESSION
MAULIK PANCHAL, HARSH PATEL, PARITOSH CHAUDHURI
IPR/RR-1595/2023 DECEMBER 2023

NUMERICAL DESIGN AND EXPERIMENTAL CHARACTERIZATION OF RECONFIGURABLE LEAKY WAVE PLASMA ANTENNA
R. R. HIRANI, A. SINHA, A. K. PANDEY, S. K. PATHAK, S. N. SHAH
IPR/RR-1596/2024 JANUARY 2024

COMPUTATIONAL FLUID DYNAMICS MODELLING AND VALIDATION OF ROTATING DETONATION ENGINE
SUNIL BASSI, KALUKURTHY TONY SANDEEP, AND VENKATA RAMANA IKKURTHI
IPR/RR-1597/2024 JANUARY 2024

IMPACT OF TOROIDAL FIELD GENERATED ERROR FIELD OVER ADITYA OHMIC START-UP
S. PUROHIT, J. GHOSH, M.K. GUPTA, K. A. JADEJA, M.B. CHOWDHURI, R. MANCHANDA, K. PATEL, S.B. BHATT, M. MAKWANA, C.N. GUPTA, S.K. PATHAK, R.L. TANNA, Y.C. SAXENA, and ADITYA TEAM
IPR/RR-1598/2024 JANUARY 2024

OVERVIEW OF PHYSICS RESULTS FROM THE ADITYA-U TOKAMAK AND FUTURE EXPERIMENTS
R.L. TANNA, J. GHOSH, K.A. JADEJA, ROHIT KUMAR, SUMAN AICH, K.M. PATEL, HARSHITA RAJ, KAUSHLENDER SINGH, SUMAN DOLUI, KAJAL SHAH, S. PATEL, NANDINI YADAVA, TANMAY MACWAN, A. KANIK, ANKIT KUMAR, BHARAT HEGDE, ASHOK KUMAWAT, A. KUNDU, R. JOSHI, DEEPTI SHARMA, ANKIT PATEL, L. PRADHAN, K. GALODIYA, SHWETANG PANDYA, SOUMITRA BANERJEE, SK INJAMUL HOQUE, KOMAL, M.B. CHOWDHURI, R. MANCHANDA, N. RAMAIYA, RITU DEY, G. SHUKLA, D. MODI, VISHAL SHARMA, AMAN GAUTTAM, M.N. MAKWANA, KUNAL SHAH, S. GUPTA, SUPRIYA NAIR, S. PUROHIT, U.C. NAGORA, A. ADHIYA, KIRAN PATEL, KUMUDNI ASUDANI, S.K. JHA, D. KUMAWAT, SANTOSH PANDYA, VARSHA S., PRAVEENLAL EDAPPALA, B. ARAMBHADIYA, MINSHA SHAH, PRAMILA GAUTAM, V. RAULJI, PRAVEENA SHUKLA, ABHIJEET KUMAR, MITESH PATEL, R. RAJPAL, M. BHANDARKAR, IMRAN MANSURI, KIRTI MAHAJAN, K. MISHRA, SUNIL KUMAR, B.K. SHUKLA, JAGABANDHU KUMAR, P.K. SHARMA, SNEHLATA AGGARWAL, KUMAR AJAY, M.K. GUPTA, S.K. PATHAK, P.K. CHATTOPADHYAY, D. RAJU, S. DUTTA, S. PAHARI, N. BISAI, CHETNA CHAUHAN, Y.C. SAXENA, A. SEN, R. PAL and S. CHATURVEDI
IPR/RR-1599/2024 JANUARY 2024

STUDY OF MHD INSTABILITIES USING FAST VISIBLE IMAGING DIAGNOSTIC IN ADITYA-U TOKAMAK

DEVILAL KUMAWAT, KUMUDNI TAHILIANI, KAUSHLENDER SINGH, SUMAN DOLUI, SAMEER KUMAR, SURESH I, R.L TANNA, KAUSHAL M PATEL, KUMARPALSINH JADEJA, MANOJ K GUPTA, S.K PATHAK, JOYDEEP GHOSH, and ADITYA-U TEAM
IPR/RR-1600/2024 JANUARY 2024

INVESTIGATING THE EFFICACY OF PLASMA WASHING FOR STAINS REMOVAL

VIKAS RATHORE and SUDHIR KUMAR NEMA

IPR/RR-1601/2024 JANUARY 2024

NUMERICAL SIMULATION OF AN EXPANDING MAGNETIC FIELD PLASMA THRUSTER USING IODINE FUEL
VINOD SAINI, RAJARAMAN GANESH
IPR/RR-1602/2024 JANUARY 2024

AUTOMATED LABELLING AND CORRELATION ANALYSIS OF DIAGNOSTIC SIGNALS FROM ADITYA TOKAMAK FOR DEVELOPING AI BASED DISRUPTION MITIGATION SYSTEMS
J. AGARWAL, B. CHAUDHARY, S. JAKHAR, N. SHAH, S. ARORA, D. SONI, M. SHARMA
IPR/RR-1603/2024 JANUARY 2024

INFLUENCE OF WALL ON PLASMA TRANSPORT ACROSS MAGNETIC FILTER FIELD IN A NEGATIVE ION SOURCE: A 2D-3V PIC MCC SIMULATION STUDY
MIRAL SHAH, BHASKAR CHAUDHURY, MAINAK BANDYOPADHYAY
IPR/RR-1604/2024 JANUARY 2024

ON SPIN OF PLASMA BLOB IN EDGE AND SCRAPE-OFF LAYER REGIONS OF A TOKAMAK
N BISAI
IPR/RR-1605/2024 FEBRUARY 2024

RADIAL POSITION MEASUREMENT OF PLASMA COLUMN USING SOFT X-RAY DIAGNOSTICS IN ADITYA-U TOKAMAK
A. ADHIYA, A. KUMAR, M. K. GUPTA, P. KUMARI, D. K. SAINI, S. K. GUPTA, M. CHAVDA, S. PUROHIT, K. GARG, R. RAJPAL, S. K. PATHAK, R. KUMAR, S. AICH, H. RAJ, R. TANNA, J. GHOSH, and ADITYA-U TEAM
IPR/RR-1606/2024 FEBRUARY 2024

SIMULATION STUDY OF 4 kV, 5A MODULAR MULTILEVEL CONVERTER AS A RECTIFIER
MEDDI THARUN, ARITRA CHAKRABORTY, ASHOK MANKANI, VIVEK PATEL, KUMAR SAURABH, ADITYA NAUGRAIYA, AMAL S, PAUL D CHRISTAIN, UJJWAL KUMAR BARUAH
IPR/RR-1607/2024 FEBRUARY 2024

CONCEPTUAL DESIGN OF COPPER OXIDE (CuO) METAL BED FOR FUSION FUEL CYCLE
RUDREKSH B. PATEL, RAJENDRA BHATTACHARYAY, PARITOSH CHAUDHURI
IPR/RR-1608/2024 FEBRUARY 2024

OFF-TARGET GRADIENT DRIVEN FLOWS IN 3D SIMULATIONS OF ADITYA-UPGRADE TOKAMAK SCRAPE-OFF-LAYER PLASMA TRANSPORT
ARZOO MALWAL, BIBHU PRASAD SAHOO, DEVENDRA SHARMA, and YUHE FENG
IPR/RR-1609/2024 FEBRUARY 2024

GYROKINETIC SIMULATIONS OF ELECTROSTATIC MICROTURBULENCE IN ADITYA-U TOKAMAK WITH ARGON IMPURITY
TAJINDER SINGH, KAJAL SHAH, DEEPTI SHARMA, JOYDEEP GHOSH, KUMARPALSINH A. JADEJA, RAKESH L. TANNA, ZHIHONG LIN, ABHIJIT SEN, SARVESHWAR SHARMA, ANIMESH KULEY

IPR/RR-1610/2024 FEBRUARY 2024

DESIGN CONSIDERATIONS FOR ACTIVE POSITION MAGNET CONTROL POWER SUPPLY FOR PLASMA VERTICAL POSITION CONTROL IN ADITYA-U TOKAMAK
ROHIT KUMAR, HARSHITA RAJ, VINAY MENON, DEEPTI SHARMA, DARSHAN PARMAR, DINESH SHARMA, VISHAL JAIN, YSS SRINIVAS, SHIVAM GUPTA, RAKESH TANNA, ASHOK MANKANI and JOYDEEP GHOSH
IPR/RR-1611/2024 FEBRUARY 2024

TRAPPED ELECTRON COUPLED ITG TURBULENCE SIMULATION FOR ADITYA-U
AMIT K. SINGH, S. CHOUDHARY, M. GOPAL KRISHNA, J. MAHAPATRA, A. BOKSHI, J. CHOWDHURY, R. GANESH, T. HAYWARD-SCHNEIDER, E. LANTI, A. MISHCHENKO, B. F. MCMILLAN and L. VILLARD
IPR/RR-1612/2024 FEBRUARY 2024

NUMERICAL SIMULATION OF AN EXPANDING MAGNETIC FIELD PLASMA THRUSTER: A COMPARATIVE STUDY FOR ARGON, XENON AND IODINE FUEL GASES
VINOD SAINI, RAJARAMAN GANESH
IPR/RR-1613/2024 FEBRUARY 2024

UBIQUITOUS MODES IN TOKAMAKS
SAGAR CHOUDHARY, JUGAL CHOWDHURY, M GOPAL KRISHNA, JAGANNATH MAHAPATRA, AMIT K. SINGH, RAJARAMAN GANESH, LAURENT VILLARD
IPR/RR-1614/2024 FEBRUARY 2024

FRACTIONAL-ORDER MODELLING AND ANALYSIS OF MODULAR MULTILEVEL CONVERTER
VIVEK PATEL, ASHOK MANKANI, KUMAR SAURABH, ARITRA CHAKRABORTY, ADITYA NAUGRAIYA, MEDDI THARUN, RAJESH KUMAR
IPR/RR-1615/2024 FEBRUARY 2024

UNDERWATER IN-SITU PLASMA TREATMENT OF COARSE WOOL FIBERS FOR SCOURING AND BLEACHING
NISHA CHANDWANI, HIMANSHU PANDEY and VISHAL JAIN
IPR/RR-1616/2024 FEBRUARY 2024

NUMERICAL VALIDATION OF YUKAWA FLUID EXCITATIONS WITHIN THE QUASILOCALIZED CHARGE APPROXIMATION (QLCA) THEORY
PRINCE KUMAR, and DEVENDRA SHARMA
IPR/RR-1617/2024 FEBRUARY 2024

DESTABILIZATION OF A TOROIDAL ELECTRON PLASMA VORTEX BY IONS VIA IMPACT IONIZATION OF BACKGROUND NEUTRALS
S. KHAMARU, R. GANESH, and M. SENGUPTA
IPR/RR-1618/2024 FEBRUARY 2024

INVESTIGATION OF ELECTROMAGNETIC FLUCTUATION IN MAGNETICALLY SCREENED HIGH BETA PLASMA
AYAN ADHIKARI, A. K. SANYASI, L. M. AWASTHI, P. K. SRIVASTAVA, MAINAK BANDOPADHYAY, DEVENDRA SHARMA, ANSHU VERMA, and RITESH SUGANDHI
IPR/RR-1619/2024 FEBRUARY 2024

SYSTEM FOR MICROWAVE PLASMA EXPERIMENTS (SYMPLE) FOR INVESTIGATION OF MICROWAVE ABSORPTION IN OVER-DENSE PLASMA
PRIYAVANDANA J. RATHOD, ANITHA V P, and D V GIRI

IPR/RR-1620/2024 MARCH 2024

PHYSICS AND ENGINEERING CONSIDERATIONS FOR COMPACT FUSION PILOT PLANTS
P. N. MAYA, P. PRAJAPATI, S.P. DESHPANDE, P.K. SHARMA, M. GHATE, C. DANANI, V. MEHTA, H.L. SWAMI, U. PRASAD, and P. CHAUDHURI
IPR/RR-1621/2024 MARCH 2024

SELF-INDUCED CONVECTIVE PATTERN FORMATIONS IN DUSTY PLASMA EXPERIMENTS
ANKIT DHAKA, P. BANDYOPADHYAY, PV SUBHASH, and A. SEN
IPR/RR-1622/2024 MARCH 2024

RELATIVISTIC ATOMIC STRUCTURE CALCULATIONS OF Li-LIKE IONS USED FOR PLASMA DIAGNOSTIC STUDIES
GAJENDRA SINGH, A K SINGH, M. B. CHOWDHURI, and T. NANDI
IPR/RR-1623/2024 MARCH 2024

DESIGN OF HIGH-FREQUENCY PULSE TUBE CRYOCOOLER FOR SAMPLE TESTING IN CRYO-PUMP APPLICATIONS
SARVESH KASHYAP, ABHINAV B. DESAI, HEMANG S. AGRAVAT, SAMIRAN MUKHERJEE, VISHAL GUPTA, JYOTI S. MISHRA, MONI BANAUDHA, PARESH PANCHAL, PRATIK A NAYAK and RANJANA GANGRADEY
IPR/RR-1624/2024 MARCH 2024

EXPERIMENTAL INVESTIGATION OF AN ELECTRONEGATIVE CYLINDRICAL CAPACITIVELY COUPLED GEOMETRICALLY ASYMMETRIC PLASMA DISCHARGE WITH AN AXISYMMETRIC MAGNETIC FIELD
SWATI DAHIYA, NARAYAN SHARMA, SHIVANI GEETE, SARVESHWAR SHARMA, NISHANT SIRSE and SHANTANU KARKARI
IPR/RR-1625/2024 MARCH 2024

ALUMINIDE COATINGS ON Ni BASED SUPERALLOYS
ARUNSINH B ZALA, KAUSTUBH SAMVATSAR, VYOM DESAI, VANDANA RAO, ATUL SHARMA, N. I JAMNAPARA
IPR/RR-1626/2024 MARCH 2024

OBSERVER-BASED TIME VARYING LINEAR QUADRATIC CONTROL OF MODULAR MULTILEVEL CONVERTER
VIVEK PATEL, ASHOK MANKANI, KUMAR SAURABH, ARITRA CHAKRABORTY
IPR/RR-1627/2024 MARCH 2024

AGGREGATE MORPHING OF SELF-ALIGINING SOFT ACTIVE DISKS IN SEMI-CONFINED GEOMETRY
ANSHIKA CHUGH, SOUMEN DE KARMAKAR, RAJARAMAN GANESH
IPR/RR-1628/2024 MARCH 2024

ASSESSING THE PRESERVATION EFFECTIVENESS: A COMPARATIVE ANALYSIS OF PLASMA ACTIVATED WATER AND VARIOUS PRESERVATIVES ON CAPSICUM ANNUUM L. (JALAPENO AND PUSA JWALA)
VIKAS RATHORE, PIYUSH SHARMA, ARUN PRASATH VENUGOPAL, and SUDHIR KUMAR NEMA
IPR/RR-1629/2024 MARCH 2024

MATCHING PARAMETER ESTIMATION FOR HIGH POWER ICP SOURCES USING MACHINE LEARNING TECHNIQUES
HIMANSHU TYAGI, MV JOSHI, MAINAK

BANDYOPADHYAY, MJ SINGH, KAUSHAL PANDYA, and ARUN CHAKRABORTY
IPR/RR-1630/2024 MARCH 2024

DESIGN, FABRICATION AND VALIDATION OF AN ELECTRICAL CONDUCTIVITY PRINCIPLE BASED TWO-PHASE DETECTION SENSOR ARRAY FOR MOLTEN LEAD (Pb) BASED HEAVY METAL COOLANTS UP TO 600°C
A. SARASWAT, R. BHATTACHARYAY, S. GEDUPUDI and P. CHAUDHURI
IPR/RR-1631/2024 MARCH 2024

DEUTERIUM PERMEATION STUDIES THROUGH BARE AND Er_2O_3 COATED SS 316L
S. RAI, P. A. RAYJADA, P. B. DHORAJIYA, R. B. PATEL, S. K. SHARMA, A. SIRCAR AND R. BHATTACHARYAY
IPR/RR-1632/2024 MARCH 2024

VISIBLE CAMERA IMAGE INTERPRETATION OF TOKAMAK PLASMA USING DEEP LEARNING METHOD
VISHNU CHAUDHARI, SURAJ GUPTA and MANOJ GUPTA
IPR/RR-1633/2024 MARCH 2024

SUSTAINABLE HEAT TRANSFER: OPTIMAL MIXING RATIO IN MgO-SiO_2 HYBRID NANOFLUID
SAYANTAN MUKHERJEE, PARITOSH CHAUDHURI, PURNA CHANDRA MISHRA
IPR/RR-1634/2024 MARCH 2024

D.2.2 Technical Reports

Material Characterization using Vector Network Analyser & Determination of Dielectric Properties
RIMJHIM RAJPUT, ABHISHEK SINHA, VARSHA SIJU and S. K. PATHAK
IPR/TR-730/2023 (April 2023)

Conceptual Design of 3T High Temperature Superconducting Magnet
UPENDRA PRASAD, DEVENKUMAR KANABAR, PIYUSH RAJ, MAHESH GHATE, PANKAJ VARMORA, SWATI ROY, ARUN PANCHAL, DHAVAL BHAVSAR and VIPUL TANNA
IPR/TR-731/2023 (May 2023)

Energy calibration of Silicon Drift Detector based Spectrometer for ADITYA-U Plasma start-up studies
Y.TAUNK, S. PUROHIT, M.K. GUPTA, K. GARG
IPR/TR-732/2023 (May 2023)

Procedure of Helium Turbine Assembly with Cold Box, Pressure Test and Leak Test
O.CHANDRATRE and A. K. SAHU
IPR/TR-733/2023 (May 2023)

3D-DIC Technique for out-of-Plane Displacements: Its Validation and Application
KEDAR BHOPE, MAYUR MEHTA, SAMIR KHIRWADKAR, NIKUNJ PATEL, PRAKASH MOKARIYA and TUSHAR PATEL
IPR/TR-734/2023 (May 2023)

In-House Break-Down Maintenance of Imported Cryo-Pump
VINOD D. KAILA, LAVKESH LACHHVANI, VIJAY PATEL, SUDHIR TRIPATHI, MANOJ K.GUPTA, NIKHIL MOHURLE, YOGESH YEOLE, MANU BAJPAI, PRABAL K. CHATTOPADHYAY and K. A. JADEJA
IPR/TR-735/2023 (May 2023)

Assessment of Stacked LSTM, Bidirectional LSTM, ConvLSTM2D and Auto Encoders LSTM

Time Series
Regression Analysis at Aditya-U Tokamak
RAMESH JOSHI, JOYDEEP GHOSH, NILESH KALANI, R. L. TANNA and ADITYA/ADITYA-U TEAMS
IPR/TR-736/2023 (May 2023)

Development of Compound Pendulum Based Thrust Diagnostic for Helicon Plasma Thruster
RENU BAHL, BHOOMI KHODIYAR, MRITUNJAY KUMAR, NARENDER SINGH, BUDDU RAMESH KUMAR and PRABAL KUMAR CHATTOPADHYAY
IPR/TR-737/2023 (May 2023)

A Simulation Analysis of 30 kV / 5A DC Power Supply for Neutral Beam Injectors
ADITYA NAUGRAIYA, ARITRA CHAKRABORTY, KUMAR SAURABH, ASHOK MANKANI
IPR/TR-738/2023 (June 2023)

Two-Dimensional Steady-State Thermal Analysis of PINI Ion Source Back Plate Under High Heat Flux Condition
TEJENDRA PATEL, MUKTI RANJAN JANA, UJJWAL BARUAH
IPR/TR-739/2023 (June 2023)

Comparison of inference implementation on Raspberry pi and Jetson Nano for deep learning model at ADITYA-U
RAMESH JOSHI, JOYDEEP GHOSH, NILESH KALANI AND R. L. TANNA
IPR/TR-740/2023 (June 2023)

Analysis of different inference implementations for deep learning model on ADITYA-U tokamak
RAMESH JOSHI, JOYDEEP GHOSH, NILESH KALANI AND R. L. TANNA
IPR/TR-741/2023 (June 2023)

Design, fabrication and assembly of a two-phase detection sensor array for molten lead (Pb) based heavy metal coolants
ABHISHEK SARASWAT, RAJENDRAPRASAD BHATTACHARYAY AND SATEESH GEDUPUDI
IPR/TR-742/2023 (July 2023)

Design and development of Hydrogen Isotopes Extraction System at IPR
RUDREKSH B. PATEL, PRAGNESH B. DHORAJIYA, SUDHIR RAI, P. A. RAYJADA, DEEPAK SHARMA, ADITYA VERMA, AMIT SIRCAR, RAJENDRA BHATTACHARYAY, PARITOSH CHAUDHURI
IPR/TR-743/2023 (July 2023)

Indigenous Development of Epoxy Resin System for Cryogenic Services and Fusion Application
RAJIV SHARMA, ALKESH M MAVANI and V L TANNA
IPR/TR-744/2023 (July 2023)

Development and Measurements Using Diamagnetic Loop in Aditya-U Tokamak
S. AICH, T. M. MACWAN, K. GALODIYA, K. SINGH, S. DOLUI, J. GHOSH, R. L. TANNA, L. K. PRADHAN, ABHIJEET KUMAR, H. MANDLIYA, PRAVEENLAL E. V., B. HEGDE, R. KUMAR, A. KUMAR, A. KUMAWAT, K. A. JADEJA, K. PATEL, A. PATEL and ADITYA-U TEAM
IPR/TR-745/2023 (July 2023)

A CFD Analysis of the Rotating Target Holder of the 4-MeV Neutron Generator
SNEHAL JAYSWAL, MANOJ KUMAR GUPTA, SUDHIRSINH VALA, RATNESH KUMAR, RAJESH KUMAR
IPR/TR-746/2023 (July 2023)

Monitoring the Behaviour of Electromagnetic Coil Insulation under Varying Operational conditions in ADITYA-U Tokamak
ROHIT KUMAR, HARSHITA RAJ, LAXMIKANTA PRADHAN, SUMAN AICH, KAUSALENDER SINGH, SUMAN DOLUI, ANKIT KUMAR, BHARAT HEGDE, ASHOK KUMAWAT, R.L TANNA, and J. GHOSH
IPR/TR-747/2023 (July 2023)

Design of Liquid Nitrogen Cooled Large Size Cryopump
HEMANG S. AGRAVAT, SAMIRAN S. MUKHERJEE, VISHAL GUPTA, PARESH PANCHAL, PRATIK NAYAK, JYOTI SHANKAR MISHRA, RANJANA GANGRADEY
IPR/TR-748/2023 (July 2023)

Design and Characterization of High Temperature Black Body Source in Microwave-Millimetre wave Spectrum for radiometric calibration
VARSHA SIJU, S.K.PATHAK
IPR/TR-749/2023 (August 2023)

Remote Plasma Experiment (2023)
SNEHARSH BELSARE, K. K. MOHANDAS, PRASHANT KUMAR, A. V. RAVI KUMAR
IPR/TR-750/2023 (August 2023)

Implementation and Validation of Drift Free Integrators
PRAVEENA KUMARI, RACHANA RAJPAL, VISMAYSINH RAULJI, SAMEER JHA, KUMUDNI TAHILIANI, DANIEL RAJU
IPR/TR-751/2023 (August 2023)

Hazard & Operability (HAZOP) Study Report of Lead Lithium Loop
ANITA PATEL, SHRIKANT VERMA, ABHISHEK SARASWAT, RUDREKSH PATEL, ANKUSH V. DEOGHAR, ANKIT GANDHI, RAJENDRAPRASAD BHATTACHARYAY
IPR/TR-752/2023 (August 2023)

Performance Results of Upgraded Cryogenic System with 4 Cryo-condensation Pumps During 0.2 to 0.7 MW Positive Neutral Beam Operation
CH. CHAKRAPANI, B. SRIDHAR, B. CHOKSI, L.K. BANSAL, VIJAY VADHER, KARISHMA Q, SANJAY L PARMAR, NILESH CONTRACTOR, VISHNU PATEL, BHARGAV PANDYA, V. PRAHLAD,
PARESH PATEL, and U.K.BARUAH
IPR/TR-753/2023 (August 2023)

Two-Dimensional Digital Image Correlation Technique for Different Applications
MAYUR MEHTA, KEDAR BHOPE, S. S. KHIRWADKAR, N.C. GUPTA, JIGNESH CHAUHAN, HARDIK TAILOR, MAULIK PANCHAL, ABHISHEK SARASWAT, PARITOSH CHAUDHURI, A, K. SAHU, SUNIL BELSARE, TUSHAR PATEL
IPR/TR-754/2023 (August 2023)

Design, Simulation and Implementation of Structural Support for Cylindrical High Temperature Reactor
ATIKKUMAR N. MISTRY, HEMANG AGRAVAT, VISHAL JAIN, S.K. NEMA
IPR/TR-755/2023 (August 2023)

3D MHD Flow Analysis in a Circular Duct with Different Wall Electrical Conductivity
A. PATEL, R. BHATTACHARYAY
IPR/TR-756/2023 (August 2023)

Development and Testing of a Pneumatic Mechanical Punch for Application in Cryogenic Pellet Injection
PARESH PANCHAL, J S MISHRA, HEMANG AGRAVAT, SAMIRAN MUKHERJEE, MONI

BANAUDHA, RANJANA GANGRADEY
IPR/TR-757/2023 (August 2023)

Electrical and thermal property measurement of the cement coated graphite
K.P SINGH, SAMIR S KHIRWADKAR, PRIYANKA PATEL, ALPESH PATEL, SIJU GEORGE, KEDAR BHOPE, SMIT GAJJAR, PRAKASH MOKARIA, VYOM DESAI
IPR/TR-758/2023 (August 2023)

Eddy Current Testing for Non-destructive testing of Plasma Facing Components
KEDAR BHOPE, MAYUR MEHTA, SAMIR KHIRWADKAR
IPR/TR-759/2023 (August 2023)

Numerical Computation of Electric Field Distribution for HVDC Systems at R&D Facilities
ARITRA CHAKRABORTY, AMAL S, SAURABH KUMAR, PAUL D. CHRISTIAN, ADITYA NAUGRAIYA, ASHOK MANKANI and UJJWAL KUMAR BARUAH
IPR/TR-760/2023 (August 2023)

Parametric Analysis of Receiver Radio Frequency Section for Reflectometry Diagnostic Using MATLAB
VISHNU CHAUDHARY, JJU BUCH, and S.K. PATHAK
IPR/TR-761/2023 (September 2023)

An approach for control of equilibrium field profile through the real-time plasma current in ADITYA-U and SST-1 tokamaks
SHIVAM KUMAR GUPTA, KUNAL S SHAH, M N MAKWANA, ROHIT KUMAR, R L TANNA, JASRAJ DHONGDE, AVEG KUMAR, B V NAIR, S NAIR, JOYDEEP GHOSH, D RAJU
IPR/TR-762/2023 (September 2023)

Design and Analysis of Cryostat System for the Testing of 3T-HTS Magnet
PRABAL BISWAS, SUDHIR TRIPATHI, MANOJ K. GUPTA, SWADESH PATNAIK, SNEHAL JAYSWAL, MAHESH M. GHATE, DEVEN KANABAR, PIYUSH RAJ, SWATI ROY, PANKAJ VARMORA, UPENDRA PRASAD
IPR/TR-763/2023 (September 2023)

Design, Simulation, Analysis, Fabrication and Testing of Toroidal Field Power Supply (TFPS) for Simple Tight Aspect Ratio Machine Assembly
SUPRIYA A. NAIR, URMIL THAKER, and TULCHHI RAM
IPR/TR-764/2023 (October 2023)

Calibration and Power Measurement Experiments for 95 GHz Water Cooled Dummy Load
HARDIK MISTRY, HARSHIDA PATEL, NANI MEDICHERLA, P SRIKRISHNA, JATIN PATEL, DHARMESH PUROHIT, K G PARMAR, SANTANU KARMAKAR and B. K. SHUKLA
IPR/TR-765/2023 (October 2023)

Development of Tool for Sign Language to Text Conversion
A. SHARMA, A. ABHISHEK, M. SHARMA
IPR/TR-766/2023 (October 2023)

Artificial Intelligence based Face Recognition: Advancements and Applications
A. ABHISHEK, A. SHARMA, M. SHARMA
IPR/TR-767/2023 (October 2023)

Conceptual Design of Cryostat system used for testing of 3T-HTS Magnet
PRABAL BISWAS, SUDHIR TRIPATHI, MAHESH M. GHATE, MANOJ K. GUPTA, SWADESH PATNAIK, SNEHAL JAYSWAL, DEVEN KANABAR, PIYUSH RAJ, SWATI ROY, PANKAJ VARMORA, UPENDRA PRASAD

IPR/TR-768/2023 (October 2023)

Improved Horizontal Plasma Position Control Using c-RIO Based Real Time System in Aditya-U
PRAMILA GAUTAM, VISMAYSINH RAULJI, ROHIT KUMAR, RACHANA RAJPAL, RAKESH TANNA, JOYDEEP GHOSH, and ADITYA-U TEAM
IPR/TR-769/2023 (October 2023)

Control System Architecture for Integrated and Simultaneous Operation of Multiple Probe Drives for an Experimental Plasma System
JIGNESH PATEL, ROSH ROY, KALPESH DOSHI, TANMAY KARMAKAR, IMRAN MANSURI, MANISHA BHANDARKAR, KIRTI MAHAJAN and PRABAL CHATTOPADHYAY
IPR/TR-770/2023 (October 2023)

On-site Determination of Effective Turn-Area of Magnetic Probes for Aditya-U Tokamak
SAMEER KUMAR, KUMUDNI TAHILIANI, PRAVEENA KUMARI, PRAVEENLAL EDAPPALA, I SURESH, KUNAL S SHAH, DANIEL RAJU, RACHNA RAJPAL, SURYA KUMAR PATHAK, ROHIT KUMAR, RAKESH L TANNA, HARSHITA RAJ, JOYDEEP GHOSH and ADITYA-U TEAM
IPR/TR-771/2023 (November 2023)

Design and Simulation of High Temperature Thermally Insulated Chamber to Operate Graphite Electrode Based Plasma Arc
ATIKKUMAR N. MISTRY, DEEPAK SHARMA, HEMANG AGRAVAT, VISHAL JAIN, S.K NEMA
IPR/TR-772/2023 (November 2023)

Design, In-House Fabrication and Mounting of Optical Fibre Mount-cum-Optical Filter Holder
SUMANAICH, SARVIL PATEL, LAXIMIKANTA PRADHAN, MALAY BIKAS CHOWDHURI and JOYDEEP GHOSH
IPR/TR-773/2023 (November 2023)

Investigating the Occurrence and Predictability of Pitch Angle Scattering Events at Aditya-Upgrade Tokamak with the Electron Cyclotron Emission Radiometer
VARSHA SIJU, SANTOSH P. PANDYA, S. K. PATHAK, ANSH PATEL, UMESH NAGORA, SHISHIR PUROHIT, SAMEER JHA, M. K. GUPTA, K. TAHILIANI, R. KUMAR, R. L. TANNA, J. GHOSH and ADITYA-U TEAM
IPR/TR-774/2023 (November 2023)

Technical Feasibility of LabVIEW based Data Acquisition software for Fourier Transform Spectrometer
VISMAYSINH RAULJI, BHARATKUMAR ARAMBHADIYA, RACHANA RAJPAL, NARESH KALVANI, RAVINDER KUMAR, SHIVAKANT JHA, SUMAN DANANI, HITESH PANDYA, SUBROTO MUKHERJEE
IPR/TR-775/2023 (November 2023)

Establishment of a New Research and Development Facility for Exhaust Gas Treatment
K. NIGAMA, B. SAHOO, A. BORUAH, C. PATIL, G. RAVI
IPR/TR-776/2023 (December 2023)

Ethernet Based Controller for Analog Signal Conditioning Electronics
MINSHA SHAH, PRAVEENLAL EDAPPALA, RACHANA RAJPAL
IPR/TR-777/2023 (December 2023)

Data Acquisition and Trigger system for CRDS diagnostic in Negative Ion Source
HIMANSHU TYAGI, DEBRUP MUKHOPADHYAY, RATNAKAR YADAV,

HIREN MISTRI, KAUSHAL PANDYA, MANAS BHUYAN, MAINAK BANDYOPADHYAY, MJ SINGH, ARUN CHAKRABORTY
IPR/TR-778/2023 (December 2023)

Event driven High Speed Data Acquisition with IEEE 1588 synchronization for long pulse operations of Indian Test Facility for ITER DNB
H TYAGI, R K YADAV, M BHUYAN, M BANDYOPADHYAY, MJ SINGH and ARUN CHAKRABORTY
IPR/TR-779/2023 (December 2023)

Viewing Geometry Impact over the Tomographic Reconstructions and Magnetic Island Measurement
S. PUROHIT, M.K. GUPTA
IPR/TR-780/2023 (December 2023)

Commissioning and Initial Operational Experience of 2 MW AC/DC Power Converter at IPR for Neutral Beam Injector Applications
ARITRA CHAKRABORTY, SAURABH KUMAR ASHOK MANKANI, AMAL S, PAUL D. CHRISTIAN and UJJWAL KUMAR BARUAH
IPR/TR-781/2023 (December 2023)

Residual Life Enhancement of 2 Nos. of 15MVA and 1 No. of 31.5MVA, 132/11kV Power Transformers at 132kV IPR Substation
PRAKASH PARMAR, CHANDRA KISHOR GUPTA, SUPRIYA NAIR, CHIRAG BHAVSAR
IPR/TR-782/2024 (January 2024)

Electron Beam Profile Measurement using enhanced dual-techniques in High Heat Flux Test Facility at IPR
SUNIL BELSARE, KEDAR BHOPE, MAYUR MEHTA, SAMIR KHIRWADKAR, TUSHAR PATEL, RAJAMANNAR SWAMY, SRIKANTA SAHU, PRAKASH MOKARIYA, NIKUNJ PATEL
IPR/TR-783/2024 (January 2024)

Sensitivity Analysis of Tritium Modelling on LLCB TBM
PRIYANKA BRAHMBHATT, AMIT SIRCAR
IPR/TR-784/2024 (January 2024)

Development of 20kV, 50mA High Voltage DC Power Supply for the Plasma Gun experiments
BHAVESH KADIA, KIRIT PARMAR, RAVI RANJAN, YASHASHRI PATIL, SHANTANU KARAKARI, SUNIL KUMAR and HIGH POWER ICRH SYSTEMS DIVISION
IPR/TR-785/2024 (January 2024)

Disruption Prediction on Aditya/Aditya-U Using Future Sequence Based Time Series Neural Network
RAMESH JOSHI, J GHOSH, NILESH KALANI, R. L. TANNA, SUNIL KUMAR, M. BHANDARKAR, K. A. JADEJA, K. M. PATEL, ROHIT KUMAR, SUMAN AICH,SUMAN DOLUI and M. B. CHOWDHURI
IPR/TR-786/2024 (January 2024)

Electromagnetic design and analysis of 3T HTS magnet
DEVENKUMAR KANABAR, UPENDRA PRASAD, PIYUSH RAJ, MAHESH GHATE, SWATI ROY, VIPUL TANNA
IPR/TR-787/2024 (January 2024)

Design, Development and Testing of IF section for FMCW Reflectometry Diagnostics for Tokamaks
VISHNU CHAUDHARI, JJU BUCH, ROHIT MATHUR, and S.K. PATHAK
IPR/TR-788/2024 (January 2024)

Overhauling of 1700kVA Diesel Engine and Upgradation of the Controller
G. K. RAJAN, C. K. GUPTA, CHIRAG B.

BHAVSAR, PRAKASH K. PARMAR and SUPRIYA A. NAIR
IPR/TR-789/2024 (February 2024)

On-the-fly Training Architecture for Time Series Neural Network on ADITYA/ADITYA-U Data
RAMESH JOSHI, JOYDEEP GHOSH, NILESHKALANI, SUNIL KUMAR and R. L. TANNA
IPR/TR-790/2024 (February 2024)

Design and Development of Electronics for Magneto Optic Current Sensor (MOCS) diagnostic in Aditya–Upgrade Tokamak
SURESH I., SANTOSH P. PANDYA, PRAVEENLAL E. V, KUMUDNI ASSUDANI, SURYA KUMAR PATHAK
IPR/TR-791/2024 (February 2024)

Design of Metal foil Bolometer Electronics
SURESH I., PRAVEENLAL EV., DEVILAL KUMAWAT, KUMUDNI TAHILIANI, S.K.PATHAK
IPR/TR-792/2024 (February 2024)

Design Basis Report of Pb-Li Loop
A. PATEL, S. VERMA, A. SARASWAT, P. SATYAMURTHY, S. MALHOTRA, R. BHATTACHARYAY, S. GUPTA, A. PRAJAPATI, A. DEOGHAR, D. SHARMA, M. KUMAR, T. S. RAO, A. MAKWANA, A. JAISWAL, D. MOHANTA, S. K. SHARMA, V. VASAVA, H. TAILOR, S. SAHU, C. DODIYA, U. PRASAD, A. RANJAN and S. RANJITH KUMAR
IPR/TR-793/2024 (February 2024)

Design and Test of Multi-Channel FPGA based Signal Conditioning Electronics for Thermocouples for Large sized Neutral Beam Sources
HIMANSHU TYAGI, HIREN MISTRI, MAINAK BANDYOPADHYAY and ARUN CHAKRABORTY
IPR/TR-794/2024 (March 2024)

Sequential Control of Vacuum Pumping System for Helicon Plasma Thruster Experiments
PRASHANT KUMAR, RITESH SUGANDHI, KALPESH DOSHI, BUDDU RAMESH KUMAR, NARENDER SINGH, PRABAL CHATTOPADHYAY
IPR/TR-795/2024 (March 2024)

The Realization of Beamline Components and First Ion Beam Neutralization Experimental Results in ROBIN
K. PANDYA, M.J. SINGH, R.K. YADAV, V. MAHESH, R. PANDEY, H.MISTRI, B. PRAJAPATI, M. BHUYAN, S. DASH, J. BHAGORA, A. GAHLAUT, M. BANDYOPADHYAY, V. PRAJAPATI, and A. CHAKRABORTY
IPR/TR-796/2024 (March 2024)

Enhancement and Comprehensive Testing of Interlock Protection Systems of High Heat Flux Test Facility at IPR
SUNIL BELSARE, TUSHAR PATEL, KEDAR BHOPE, MAYUR MEHTA, SAMIR KHIRWADKAR, RAJAMANNAR SWAMY, PRAKASH MOKARIYA, NIKUNJ PATEL
IPR/TR-797/2024 (March 2024)

D.3 CONFERENCE PRESENTATION

4th IEEE International Conference Power, Instrumentation, Control, and Computing (PICC 2023), Government Engineering College, Thrissur, 19-21 April 2023

Simulation and Implementation of a 350kV, 50mA High Voltage DC Generator for Particle Accelerator Applications

Amal S, Pooja Joshi, Ashok Mankani, Aritra Chakraborty, Paul D. Christian, Saurabh Kumar and Ujjwal Baruah

21st International Conference on Atomic Processes in Plasmas, Vienna International Centre, Vienna, Austria, 15-19 May 2023

Estimation of Argon impurity transport in Aditya-U Ohmic discharges using Be-like, B-like and Cl-like Argon spectral line emissions
K. Shah, S. Patel, M.B. Chowdhuri, K.A. Jadeja, G. Shukla, T. Macwan, A. Kumar, S. Dolui, K. Singh, R.L. Tanna, K.M. Patel, R. Dey, R. Manchanda, N. Ramaiya, R. Kumar, S. Aich, N. Yadava, S. Purohit, M.K. Gupta, U.C. Nagora, S. K. Pathak, P. K. Atrey, K.B.K. Mayya and J. Ghosh

International Workshop on Active Matter at Surfaces and in Complex Environments, Max Planck Institute for the Physics of Complex Systems, Dresden, 19-23 June 2023

Soft active particles in confined geometries
Anshika Chugh, Soumen De Karmakar, Rajaraman Ganesh

DAE-BRNS National Symposium on High Voltage-Energy Storage Capacitors and Applications (HV-ESCA-2023), DAE Convention Centre, Anushakti Nagar, Mumbai, 22-24 June 2023

Review of Cockcroft-Walton High Voltage Low Current DC Power Supplies
Urmil M. Thaker, Santosh C. Vora

Upgrade of 250 kJ capacitor bank system in ADITYA-U tokamak
Rohit Kumar, Bharat Arambhadiya, Vismay Raulji, Minsha Shah, Praveenlal Edappala, Pramila Gautam, Harshita Raj, Suman Aich, Kaushlender Singh, Suman Dolui, R.L. Tanna, R. Rajpal, and J. Ghosh

Capacitor Bank-Based Power Supply used for Shaped Plasma Operation in ADITYA-U tokamak, a milestone in Indian Fusion Program
Harshita Raj, R. Kumar, R.L. Tanna, J. Ghosh, Bharat Arambhadiya, Vismay Raulji, Minsha Shah, K.A. Jadeja, K.M. Patel, K. Singh, S. Dolui, A. Kumar, B. Hegde, Suman Aich, ADITYA-U and Diagnostic team

49th European Conference on plasma physics, Bordeaux, France 03-07 July 2023

Behaviour of multi-component plasma sheath in presence of charged dust particles in an oblique magnetic field: Fluid picture
Akshaya Kumar Shaw, Amulya Sanyasi and Devendra Sharma

Poloidal gradient driven off-target circulation and upstream density shoulder in EMC3-Eirene simulations of inboard limited circular scrape off-layer plasma
Arzoo Malwal, Bibhu Prasad Sahoo, Devendra Sharma

Vertical charge separation characteristic of ECR plasma in low aspect ratio toroidal plasma
Tulchhi Ram, Jagabandhu Kumar, P K Sharma, D. Raju, P.R. Parmar, KK Ambulkar

Thermal fluctuations of Strongly Coupled Dusty Plasmas: A Theoretical and Experimental Study
Ankit Dhaka, P.V. Subhash, P. Bandyopadhyay and A. Sen

30th IEEE Symposium on Fusion Engineering (SOFE 2023), Oxford, United Kingdom, 9-13 July 2023

Thermo-Physical properties and Characterization studies for Vacuum Hot-Pressed Boron Carbide (B4C) Ceramics
Bhoomi S. Gajjar, Aroh Shrivastava, Vyom Desai, N. I. Jamnapara, Hitesh Kumar B. Pandya, and Paritosh Chaudhuri

Development of piston-driven mechanical pellet launcher for hydrogen pellets
Jyoti Shankar Mishra, R. Gangradey, P. Panchal, S. Mukherjee, V. Gupta, H. S. Agravat, M. Banaudha, P. Nayak, R. Saini

Novel approach for control of equilibrium field profile through the real-time plasma current in ADITYA-U and SST-1 tokamaks
Shivam Kumar Gupta, Kunal S Shah, M N Makwana, R.L. Tanna, Rohit Kumar, Jasraj Dhongde, Aveg Kumar, B V Nair, S Nair, Joydeep Ghosh, D Raju and Aditya-U Team

Improved Horizontal Plasma Position Control Using c-RIO based real time System in ADITYA-U
P. Gautam, V. Raulji, Rohit Kumar, R. Rajpal, R.L. Tanna, J. Ghosh

3rd Conference on Plasma Simulation (CPS), Raman Science Centre, Indian Institute of Astrophysics, Leh, Ladakh, 13-15 July 2023

Neural network assisted electrostatic global gyrokinetic toroidal code using cylindrical coordinates
Jaya Kumar, Joydeep Das, Sarveshwar Sharma, Animesh Kuley

Simulation and Analytical Models of Low Temperature Magnetized Plasmas created for Laboratory experiments
S. K. Karkari, Y. Patil, S. Das, Swati, P. Singh, S. Binwal, J.K. Joshi, A. K. Pandey and M.P. Bhuva

Global gyrokinetic simulations of electrostatic microturbulent transport in LHD stellarator with boron impurity
Animesh Kuley, Tajinder Singh, Javier H. Nicolau, Federico Nespoli, Gen Motojima, Zhihong Lin, Sarveshawar Sharma, Abhijit Sen

Particle-in-cell simulation study of capacitively coupled plasma discharges excited by tailored waveform
Nishant Sirse, Sarveshwar Sharma, Miles M Turner

Propagation and damping of ion-acoustic waves in two-electron temperature plasma
S. S. Kausik, G. Sharma, K. Deka, R. Paul, S. Adhikari, R. Moulick, and B. K. Saikia

Particle-In-Cell Simulation of Electrostatic Waves in the Ionosphere
Rakesh Moulick, Sayan Adhikari, Gunjan Sharma, B. K. Saikia and W. J. Miloch

A weakly relativistic electron beam from laser-cluster interaction in an ambient magnetic field
Kalyani Swain, Mrityunjay Kundu

Simulating Charged Particle Dynamics in Ultra-Relativistic Electromagnetic Fields with Radiation-Reaction Effects
Shivam Kumar Mishra, Sarveshwar Sharma, Sudip Sengupta

Investigation of electron plasma waves in the presence of inhomogeneous immobile ions: A fluid and kinetic simulation study
Sanjeev Kumar Pandey, Jagannath Mahapatra and Rajaraman Ganesh

Effect of Stream-wise Vortices in the Spot Formation Mechanism at Large Aspect Ratios
Suruj Jyoti Kalita, Rajaraman Ganesh

Investigation of Toroidal Electron Plasmas: A 3D3V Particle-inCell Study Using OpenACC Parallelized PEC3PIC Code
Swapnali Khamaru, R. Ganesh

Massively Parallel PIC Simulations for E × B Low Temperature Plasmas: Implementation, Benchmarking and Performance Analysis
L. B. Varghese, A. Jayaram, M. A. Shah, B. Chaudhury, M. Bandyopadhyay

Particle-in-Cell Simulations with a Deep Learning-Based Solver
Sagar Choudhary, Rajaraman Ganesh

Parametric study on EM field simulations of MPCVD cavity
Kushagra Nigam, Nishant Sirse, Sarveshwar Sharma

Development of Finite Difference Time Domain (FDTD) Code for Plasma Antenna
Debashis Ghosh, Rajesh Kumar

Modelling of plasma start-up and burn-through in Tokamaks
Amit K. Singh, Kshitij V. Sharma, S. Banerjee, I. Bandyopadhyay

Modelling of Carbon Impurity Transport with Indigenously Developed Impurity Transport Code for ADITYA-U tokamak Plasma
N. Yadava, J. Ghosh, M.B. Chowdhuri, Ashoke De, N. Ramaiya, S. Patel, Ankur Pandya, R. Kumar, S. Aich, U.C. Nagora, Shishir Purohit, R.L. Tanna and ADITYA-U Team

Influence of Plasma Wall Interaction on Burn-through Phase of the ADITYA Tokamak
S. Patel, R.L. Tanna, J. Ghosh, M.B. Chowdhury, K.A. Jadeja, R. Dey, V. Sharma, R. Manchanda, N. Ramaiya, K.M. Patel, M.N. Makwana, K.S. Shah, U.C. Nagora, and K.B.K. Mayya

Focused Ion Technology for Nanomaterials – fit4nano, Lisbon, Portugal, 17-19 July 2023

Self-organized nanopatterning of Ge (100) surface under low-energy ion beam sputtering
Sukriti Hans, Mukesh Ranjan

9th PSSI - Plasma Scholars Colloquium (PSC 2023), IIT Kanpur, 20-21 July 2023

3D Computational Fluid Dynamics Analysis of PINI Ion Source Back Plate under high heat flux condition
Tejendra Patel, Mukti Ranjan Jana, Ujjwal Baruah

Metal Foil IR Bolometer development to Measure the Toroidal Radiation Asymmetry during Disruptions in Aditya-U Tokamak
Ashok Kumar Kumawat, Shwetang N. Pandya, Bharat Hegde, Ankit Kumar, Kaushlender Singh, Suman Dolui, Rohit Kumar, Harshita Raj, Suman Aich, Ananya Kundu, Laxmikant Pradhan, Ankit Patel, Kalpesh Gadoliya, Ankit Patel, K.M. Patel, K.A. Jadeja, R.L. Tanna, Joydeep Ghosh

Laser-cluster interaction in an ambient magnetic field
Kalyani Swain, Mrityunjay Kundu

Effect of Wall-Conditioning on Start-Up Phase of Discharges in Aditya-U Tokamak
Bharat Hegde, K. A. Jadeja, Ashok Kumawat, Ankit Kumar, S. Dolui, K. Singh, I. Hoque, K. Yadav, S. Banerjee, Suman Aich, Pramila Gautam, H. Raj, Nilam Ramaiya, Sharvil Patel, N. Yadava, Abha Kanik, K. Shah, Rohit Kumar, Laxmikanta Pradhan, Ankit Patel, Kalpesh Galodiiya, Shwetang N. Pandya, K.M. Patel, D. Raju R.L.

Tanna and J. Ghosh

Gas Puff Induced Current Profile Modification in ADITYA-U
Sk Injamul Hoque, T. Macwan, S. Banerjee, K. Yadav, Bharat Hegde, Ashok Kumawat, Ankit Kumar, S. Dolui, K. Singh, Suman Aich, Pramila Gautam, H. Raj, Nilam Ramaiya, Sharvil Patel, N. Yadava, Abha Kanik, K. Shah, Rohit Kumar, Laxmikanta Pradhan, K. A. Jadeja, Ankit Patel, Kalpesh Galodiiya, Shwetang N. Pandya, K.M. Patel, D. Raju, S.K. Jha, R.L. Tanna and J. Ghosh

Understanding the Working of B-Dot Probe with Shielding
Komal, I. Hoque, S. Banerjee, J. Ghosh

Vertical Wall Disruption Study
Soumitra Banerjee, Bharat Hegde, K. A. Jadeja, Ashok Kumawat, Ankit Kumar, S. Dolui, K. Singh, I. Hoque, K. Yadav, Suman Aich, Pramila Gautam, H. Raj, Nilam Ramaiya, Sharvil Patel, N. Yadava, Abha Kanik, K. Shah, Rohit Kumar, Laxmikanta Pradhan, Ankit Patel, Kalpesh Galodiiya, Shwetang N. Pandya, K.M. Patel, D. Raju R.L. Tanna and J. Ghosh

Experimental measurement of ion and electron fluctuations with and without Argon seeding using Ball Pen Probe in ADITYA-U
Ankit Kumar, Bharat Hedge, Kaushlender Singh, Suman Dolui, Ashok Kumawat, Pramila Gautam, Laxmikanta Pradhan, K. M. Patel, K. A. Jadeja, Soumitra Banerjee, Injamul Hoque, Komal, Ankit Ptel, Aman Gauttam, K.Shah, S.Patel, N.Yadava, A. Kanik, Dipexa Modi, Harshita Raj, Suman Aich, Rohit Kumar, Kalpesh Gadoliya, R.L. Tanna, Joydeep Ghosh

Toroidal Radiation Asymmetry during Plasma Disruptions in Aditya-U Tokamak
Ashok Kumar, Shwetang N. Pandya, Bharat Hegde, Ankit Kumar, Kaushlender Singh, Suman Dolui, Rohit Kumar, Harshita Raj, Suman Aich, Ananya Kundu, Laxmikant Pradhan, Ankit Patel, Kalpesh Gadoliya, Ankit Patel, K.M. Patel, K.A. Jadeja, R.L. Tanna, Joydeep Ghosh

Spectroscopic Characterization of Glow Discharge Cleaning Plasma of Aditya-U Tokamak
Dipexa Modi, Nandini Yadav, Kumarpal S. Jadeja, Malay Bikas Chowdhuri, Nilam Ramaiya, Kaushal M. Patel, Sharvil Patel, R. L. Tanna, Balamurali Krishna Mayya K and Joydeep Ghosh

Measurements of Intrinsic Toroidal Plasma Rotation Profiles using High Resolution Spectroscopic Diagnostic in Aditya-U Tokamak
K. Shah, A. Kumar, G. Shukla, M. B. Chowdhuri, R. L. Tanna, K. A. Jadeja, K. M. Patel, R. Manchanda, N. Ramaiya, R. Kumar, S. Aich, S. Dolui, K. Singh, S. Patel, A. Kanik, N. Yadava, K. B. K. Mayya, J. Ghosh and Aditya-U team

National Symposium on Gaseous Discharges (NSGD-2023), Pondicherry University, Puducherry, 9-11 August 2023

Overview of LIGO India and it commitments
Subrato Mukherjee

Plasma Material Interactions and its applications
Mukesh Ranjan

Probe diagnostics-Langmuir probe
Ramakrishna Rane

An indigenously developed ISO test facility for ESD (arc) detection on satellite solar panels
Suryakant Gupta

Development of Volume Produced Negative Ion

Source for Basic Plasma Experiment
Pawandeep Singh, Swati Dahiya, Avnish Pandey, Yashashri Patil, Shantanu Karkari

Nanopatterning using Plasma Fireball Based Ion Source
Mukesh Ranjan, Tapan Barman, Prashant K. Barnwal

Frontiers of Non-Equilibrium Plasma Sources and Applications
PI John

RF Plasma Ion Source Produced Nanopatterns for Making Uniaxial Nanoparticles Arrays
Tarundeep K. Lamba, Sebin Augustine, Mahesh Saini, Sukriti Hans, K.P. Sooraj, Mukesh Ranjan

Nonlinear Steepening of Quasi-Longitudinal Whistlers in Resonant Regime
Devendra Sharma

Hollow Cathode DC Discharge Studies using the Appel Device
Y. Patil, S Karkari

12th International Conference on Soft Computing for Problem Solving: Moving Towards Society 5.0 (SocProS-2023), Indian Institute of Technology, Roorkee, 11-13 August 2023

Analysis of different inference implementations for deep learning model on ADITYA-U tokamak
Ramesh Joshi, Joydeep Ghosh, Nilesh Kalani, RL Tanna

35th General Assembly and Scientific Symposium of the International Union of Radio Science (URSI GASS), Sapporo, Japan, 19-26 August 2023

Wideband Compact Substrate Integrated Waveguide Slot Antenna
Kundan Kumar, Shruti Priya, Swapnil Shekhar, Santanu Dwari

28th International Conference on Magnet Technology, France, 10-15 September 2023

Feasibility study of HTS current leads with MgB2 shunt for Tokamak application
Nitin Bairagi, Vipul L. Tanna, Hiren Nimavat, Dashrath Sonara, Atul Garg, Rohitkumar Panchal, Gaurang Mahesuria, Rakeshkumar Patel, Dikens Christian, Gaurav Purwar, Pradip Panchal, Upendra Prasad, and Daniel Raju

15th International Symposium on Fusion Nuclear Technology, Spain, 10-15 September 2023

Development of lab-scale Atmospheric Molecular Sieve Bed and generation of experimental break through curves for adsorption studies
Deepak Yadav, V. Gayathri Devi, Pragnesh Dhorajiya, Amit Munia, Amit Sircar, R. Bhattacharyay

Neutron Emission Characterization of IPR 14 MeV Neutron Generator
Mitul Abhangi, S. Vala, H. L. Swami, Ratnesh Kumar and Rajesh Kumar

In-Vessel Inspection System: Development and Testing Activities of High Vacuum and Temperature Technologies for Fusion Remote Handling
ManoahStephen M, Naveen Rastogi, Ravi Ranjan Kumar, Krishan Kumar Gotewal, Jignesh Chauhan, Yuvakiran P, Dilip Raval, Siju George

International Conference on Ion Sources, Canada, 17-22 September 2023

Visible camera-based diagnostic to study negative

ion beam profiles in ROBIN ion source
Sidharth Kumar Dash, Mainak Bandyopadhyay,Kaushal Pandya, Ratnakar Yadav, Manas Bhuyan, Hiren Mistri, Mahendrajit Singh

3rd International Conference on Plasma Theory and Simulations, Jawaharlal Nehru University, New Delhi, 21-23 September 2023

Analytical modelling of charge-exchange (CX) neutral particle analyzer measurements in ADITYA tokamak and estimation of CX power loss
Santosh Pandya, Snehlata Aggarwal, Kumar Ajay

Relativistic Atomic Structure Calculations of Li-Like Ions used for Plasma Diagnostics
Gajendra Singh, A. K. Singh, M. B. Chowdhuri and Tapan Nandi

Magneto-convective fluctuations in MHD duct flow of electrically conducting fluid in transverse magnetic field
Srikanta Sahu, Suneet Singh, Rajendraprasad Bhattacharyay

Parametric study of microwave field distribution in plasma sterilization chamber
Kushagra Nigam, G. Ravi, S. K. Nema

Simulation study of electron drift injection system for plasma start-up in a tokamak
Jyoti Agarwal, Someswar Dutta, Daniel Raju, Lt. R. SRINIVASAN, Shrichand Jakhar

Impact of two group of electrons in an equilibrium steady state multi component magnetized plasma sheath
Akshaya Kumar Shaw, Devendra. Sharma, Satyananda Kar and P. V. Subhash

Ion temperature modeling for the edge and Scrape-off layer plasma turbulence
Nirmal K. Bisai

Comparison of reconstruction algorithms for bolometric measurements in tokamak plasma
Vinit Pandya, Santosh Pandya, Kumudni Tahiliani, Ansh Patel

29th IAEA Fusion Energy Conference (FEC 2023), United Kingdom, 16-21 October 2023

Studies on the retarded recrystallization of tungsten in CIMPLE-PSI exposed under extreme target temperature and long He+-fluence
Mizanur Rahman, S. Chetri, S.H.B. Teo, M. Thompson, M. Bilokur, C. Corr, S. Shekhar, G. De. Temmerman and Mayur Kakati

Preliminary Divertor Plasma Operation in ADITYA-U tokamak
Rohit Kumar, H. Raj, J. Ghosh, R.L. Tanna, Vaibhav Ranjan, Kausalender Singh, Suman Dolui, Suman Aich, K. A. Jadeja, Kaushal Patel, Deepti Sharma, Ananya Kundu, Ankit Kumar, Ashok Kumawat, Bharat Hegde, M.N Makwana, Kunal Shah, Shivam Gupt, S. K. Jha1, M. B. Chowdhuri, N. Ramaiya, A. Adhiya, S. Purohit, Manoj Gupta, D. Raju, P. K. Chattopadhyay, Y. C. Saxena and the ADITYA–U Team

Simulations of inboard limited Scrape-Off Layer plasma operations in AdityaUpgrade tokamak
Arzoo Malwal, Bibhu P. Sahoo, Devendra Sharma

Trapped Electron Coupled ITG Turbulence Simulation for ADITYA - U
Amit K. Singh, S. Choudhary, J. Chowdhury, J. Mahapatra, R. Ganesh, T. Hayward - Schneider, D. Aggarwal, E. Lanti, L. Villard

Overview of Physics Results from the ADITYA-U

tokamak and Future Experiments
R.L. Tanna, J. Ghosh, K.A. Jadeja, R. Kumar, S. Aich, K.M. Patel, H. Raj, K. Singh, S. Dolui, Kajal Shah, S. Patel, N. Yadava, T. Macwan, A. Kanik, A. Kumar, B. Hegde, A. Kumawat, A. Kundu, R. Joshi, Deepti Sharma, A. Patel, L. Pradhan, K. Galodiya, S.N. Pandya, Soumitra Banerjee, Sk Injamul Hoque, Komal, M.B. Chowdhuri, R. Manchanda, N. Ramaiya, R. Dey, G. Shukla, D. Modi, V. Sharma, A. Gauttam, M.N. Makwana, K.S. Shah, S. Gupta, S. Nair, S. Purohit, U.C. Nagora, A. Adhiya, Kiran Patel, Kumudni Asudani, S.K. Jha, D. Kumawat, Santosh Pandya, Varsha S., Praveenlal Edappala, B. Arambhadiya, Minsha Shah, P. Gautam, V. Raulji, P. Shukla, Abhijeet Kumar, Mitesh Patel, R. Rajpal, M. Bhandarkar, I. Mansuri, K. Mahajan, K. Mishra, Sunil Kumar, B.K. Shukla, Jagabandhu Kumar, P.K. Sharma, S. Aggarwal, Kumar Ajay, M.K. Gupta, S.K. Pathak, P.K. Chattopadhyay, D. Raju, S. Dutta, S. Pahari, N. Bisai, Chetna Chauhan, Y.C. Saxena, A. Sen, R. Pal and S. Chaturvedi

Simulations of EDGE/SOL Characteristics including Neutral Dynamics in Limiter Plasmas of ADITYA-U Tokamak
Ritu Dey, J. Ghosh, Tanmay Macwan, Suman Dolui, Kaushlender Singh, Ankit Kumar, Abha Kanik, Nandini Yadava, M.B. Chowdhuri, N. Ramaiya, R. Manchanda, S. Patel, H. Raj, R.L. Tanna, K.A. Jadeja, K.M. Patel, R. Kumar, Suman Aich, Deepti Sharma, and A. Sen

Simulations of Unmitigated and Mitigated ITER Disruptions with Improved Halo Model in TSC
Indranil Bandyopadhyay

Challenges and Lessons Learnt During Manufacturing, Transportation and Assembly of the ITER Cryostat
Anil Kumar Bhardwaj

Helium Cooling System for DEMO R & D
Brijesh Kumar Yadav

Pre-Ionization and Plasma Startup Experiments Relevant to Fusion Devices using Spiral Antenna in Appel-Device
Y Patil

200 kW, 1 MHz Dual Directional Coupler: Design and Characterization
Akhil Jha

Realization of Beam Line Components for ITER DNB System Lessons Learnt
Jaydeep Joshi

Challenges and Lessons Learnt During Manufacturing, Transportation and Assembly of the ITER Cryostat
Anil Kumar Bhardwaj

Design Development of Nuclear Grade Vacuum Vessel for Diagnostic Neutral Beam of ITER
Ashish Yadav

Simulation Studies of Lower Hybrid Waves to Understand LHCD Experiments in SST1 Tokamak
Promod Sharma

Control of Edge and Sol Plasma Turbulence using Impurity Seeding and External Bias
Nirmal Bisai

Physics of Plasma Blob Formation and Experimental Validation
Nirmal Bisai

SARAS: A Workflow-Based Multi-Physics Simulator for Tokamak Physics and Reactor Design
P.N. Maya

Tokamak Transport under Flat Temperature Scenarios Using Global Gyro-Kinetic Simulations
Sagar Choudhary

MHD Activity Induced Excitation of GAM-like Mode in ADITYA-U tokamak
K. Singh, S. Dolui, B. Hegde, A. Kumar, A. Kumawat, T. Macwan, H. Raj, S. Patel, N. Yadava, A. Kanik, K. Shah, P. Gautam, R. Kumar, S. Aich, L. Pradhan, A. Patel, K. Galodiya, D. Raju, S.K. Jha, K.M. Patel, K.A. Jadeja, S.N. Pandya, L.T. Lachhvani, M.B. Chowdhuri, R.L. Tanna, P.K. Chattopadhyay, R. Pal, Y.C. Saxena, A. Sen, and J. Ghosh

The Bifurcation Behaviour of RMP Control of ELMs in the Presence of Plasma Flow: A Nonlinear Simulation Study
Debasis Chandra

Dissimilar Material Joints at Cryogenic Temperature for Superconducting Fusion Application
Rajiv Sharma

Development of Lead Lithium (Pb-16Li) Alloy Production System and Characterization of the Produced Alloy
Ankush Deoghar

Aabhas: A 3 Sided Fully Immersive Virtual Reality Cave Facility for Design, Operations & Maintenance of Nuclear Machines
Naveen Rastogi

Porcelain Based 100 kV Feedthrough for Prototype ITER DNB at INTF
Dheeraj Kumar Sharma

Operational Experience of SST-1: Lesson Learned
Yuvakiran Paravastu

R&D for the Development of Compact HTS Coils
Piyush Raj

Experimental and Simulation Study on SST-1 PF#3 Vacuum Barriers Arcing Incidences and Mitigation Techniques
Swati Roy

Disruption Prediction on ADITYA/ADITYA-U using Future Sequence Based Time Series Neural Network
R. Joshi, J Ghosh, Nilesh Kalani, R.L. Tanna, Sunil Kumar, M. Bhandarkar, K.A. Jadeja, K.M. Patel, R. Kumar, S. Aich, S. Dolui, M.B. Chowdhuri

Effect of Impurity Seeding on Toroidal Rotation in ADITYA-U tokamak
Ankit Kumar, K. Shah, M.B. Chowdhuri, K.A. Jadeja, N. Yadava, G. Shukla, Kaushlender Singh, Bharat Hedge, Aman Gauttam, S. Patel, Suman Dolui, Ashok Kumawat, A. Kanik, Laxmikanta Pradhan, Nilam Ramaiya, Soumitra Banerjee, Injamul Hoque, Komal, Ankit Patel, Dipexa Modi, Vishal Sharma, Harshita Raj, Suman Aich, Rohit Kumar, K.M. Patel, Kalpesh Galodiya, R.L. Tanna, and J. Ghosh

Radiation Asymmetry Studies in ADITYA-U Tokamak using Bolometer Tomography
Kumudni Tahiliani

Impurity Dynamics in Linear and Saturated Ohmic Confinement Regimes in ADITYA Tokamak
Vishal Sharma

Effect of External Magnetic Perturbation on Edge EM Instabilities in ADITYA-U Plasma
A. Kundu, J. Ghosh, S. Dolui, K.A. Jadeja, L.K. Pradhan, R. Kumar, R.L. Tanna, K. Singh, I. Hoque, S. Aich, H. Raj, S. Patel, A. Kumawat, B. Hegde, S. Banerjee, Komal, K.M. Patel, K. Galodiya, A.

Patel, A. Kumar, N. Ramaiya, N. Yadava, A. Kanik, K. Shah, D. Modi, A. Gauttam, Praveenlal E V, A. Kumar

Effect of Impurities and Wall-Conditioning Techniques on Edge Plasma Fluctuations in ADITYA-U Tokamak
Bharat Hegde

Study of MHD Instabilities and Electrostatic Oscillations using Fast Visible Imaging Diagnostic in ADITYA-U tokamak
D. Kumawat, K. Tahiliani, S.K. Jha, Suresh I, D. Raju, R.L. Tanna, K.M. Patel, K.A. Jadeja, S.K. Pathak, J. Ghosh, Aditya-U Team

Anomalous Runaway Electron Loss in ADITYA and ADITYA-U Tokamak and its Correlation with Edge Fluctuations
H. Raj, S. Dolui, K. Singh, A. Kumar, A. Kumawat, B. Hegde, S. Patel, P. Gautam, R.L. Tanna, K.A. Jadeja, R. Kumar, K.M. Patel, S. Aich, Manoj Kumar, J. Ghosh, S.K. Jha, P.K. Chattopadhyay, Y.C. Saxena, A. Sen, and R. Pal

Various experiments on runaway electron generation and mitigation in the ADITYA-U tokamak
J. Ghosh, R.L. Tanna, S. Patel, R. Kumar, H. Raj, T. Macwan, K.A. Jadeja, S. Aich, S. Dolui, K. Singh, L. Pradhan, Ankit Kumar, Bharat Hegde, Ashok Kumawat, K.M. Patel, Ankit Patel, K. Galodiya, S. Purohit, Santosh Pandya, Varsha S., U.C. Nagora, A. Adhiya, M.B. Chowdhuri, R. Manchanda, N. Ramaiya, M.N. Makwana, Kunal Shah, S. Gupta, Supriya Nair, K. Tahiliani, S.K. Jha, D. Kumawat, M.K. Gupta, S.K. Pathak, P.K. Chattopadhyay, S. Dutta, Chetna Chauhan, Y.C. Saxena and the ADITYA-U Team

Stabilization of Sawtooth Instability by Short Gas Pulse Injection in ADITYA-U tokamak
S. Dolui, K. Singh, T. Macwan, H. Raj, K. Jadeja, A. Kumar, B. Hegde, A. Kumawat, S. Patel, N. Yadava, A. Kanik, K. Shah, R. Kumar, S. Aich, K.M. Patel, U.C. Nagora, S. Purohit, M. Kumar, A. Adhiya, P. Gautam, L. Pradhan, A. Patel, K. Galodiya, R.L. Tanna, J. Ghosh

Can the Runaway Electrons Be Mitigated By Whistlers - A Laboratory Case Study
Amulya Sanyasi

Observations of Toroidal Radiation Asymmetry during Disruption in ADITYA-U Tokamak
Ashok Kumar Kumawat

A Method of Localized Wall Cleaning by Varying EC Resonance in ADITYA-U Torus
K. Mishra, R. Kumar, K.A. Jadeja, K.M. Patel, H. Raj, S. Aich, N. Ramaiya, B. Hegde, A. Kumawat, M.B. Chowdhuri, R.L. Tanna, J. Ghosh and ADITYA-U Team

Design Development of Drift Duct for Diagnostic Neutral Beam System of ITER
Venkata Nagaraju Muvvala

Runaway Simulation in ADITYA-U Tokamak Parameter Regime using Vlasov Maxwell Model
Anjan Paul

Successful Commissioning & DEMOnstration of ITER Relevant RF Performance (1MW At 170 GHz) at ITER-India Gyrotron Test Facility
Laxmikanth Rao Shambhu

EMC3-Eirene Simulations of Main Chamber Recyling on ITER
Devendra Sharma

A Staged Approach to Indian DEMO and

Technology Roadmap
Shishir Deshpande

Enhancement in plasma performance and impurity control using Argon-Hydrogen fuelled glow discharge wall conditioning in ADITYA-U tokamak
K.A. Jadeja, J. Ghosh, K.M. Patel, A.B. Patel, R.L. Tanna, Kiran Patel, B.G. Arambhadiya, K.D. Galodiya, Rohit Kumar, S. Aich, Harshita Raj, L. Pradhan, M.B. Chowdhuri, R. Manchanda, N. Ramaiya, Nandini Yadava, Sharvil Patel, Kajal Shah, A. Gauttam, K. Singh, S. Dolui, Ankit Kumar, B. Hegde, A. Kumawat, Minsha Shah, R. Rajpal, U.C. Nagora, P.K. Atrey, S.K. Pathak, Shishir Purohit, A. Adhiya, Manoj Kumar, Kumudni Assudani, D. Kumavat, S.K. Jha, K.S. Shah, M.N. Makwana, Shivam Gupta, Supriya Nair, Kishore Mishra, D. Raju, P.K. Chattopadhyay, B.R. Kataria

Magnetohydrodynamic Instability Induced Runaway Electron Transport
S. Patel, J. Ghosh, M.B. Chowdhuri, R.L. Tanna, S. Purohit, S. Dolui, K. Singh, T. Macwan, S. Aich, H. Raj, R. Kumar, K.A. Jadeja, K.M. Patel, N. Ramaiya, R. Manchanda, B. Hegde, A. Kumar, A. Kumawat, A. Kanik, N. Yadava, K. Shah, S. K. Jha, A. Adhiya, U.C. Nagora and K. B. K. Mayya

Real Time Vertical Position Estimation of Plasma Column Using Fast Imaging in ADITYA-U tokamak
S. Aich, S. Patel, L.K. Pradhan, A. Kumawat, B. Hegde, K.D. Galodiya, R.L. Tanna, K.A. Jadeja, M.B. Chowdhuri, N. Yadava, N. Ramaiya, K.M. Patel, H. Raj, A. Patel, R. Kumar, K. Singh, S. Dolui, A. Kumar, Komal, I. Hoque, S. Banerjee and J. Ghosh

Quantitative Study of Influx, Recycling and Particle Balance with Different Wall Conditioning in ADITYA-U tokamak
N. Yadava, M.B. Chowdhuri, K.A. Jadeja, K.M. Patel, R. Manchanda, N. Ramaiya, A. Patel, A. Gauttam, D. Modi, S. Patel, V. Sharma, M. Shah, A. Kumar, K. Singh, S. Dolui, B. Hegde, A. Kumawat, A. Kanik, A. Pandya, M. Makwana, R.L. Tanna, R. Kumar, S. Aich, J. Ghosh

Scaling of Intrinsic Toroidal Rotation with Stored Energy in Ohmic Plasmas of ADITYA-U tokamak
Kajal Shah, J. Ghosh, A. Kumar, G. Shukla, M.B. Chowdhuri, S.K. Jha, N. Ramaiya, R. Manchanda, N. Yadava, R.L. Tanna, K.A. Jadeja, K.M. Patel, R. Kumar, S. Aich, K. Singh, S. Dolui, S. Patel, A. Kanik, U.C. Nagora, K.B.K. Maya

Impact of the Impurity Seeding over the Runaway Electron for the Ohmically Heated ADITYA-U tokamak Plasma
S. Purohit, M.K. Gupta, M.B. Chowdhuri, Y. Taunk, S. Patel, K.A. Jadeja, K.M. Patel, N. Ramaiya, U.C. Nagora, K. Tahiliani, S. Kumar, S.A. Nair, R.L. Tanna, J Ghosh, S.K. Pathak and ADITYA-U Team

Workshop on Calibration of ITER X-ray & VUV Diagnostics, ITER, Saint Paul les Durance, France, 23-24 October 2023

Calibration strategies for the ITER Hard X-ray Monitor
Santosh P. Pandya, Patryk Nowak vel Nowakowski, Ansh Patel, Dariusz Makowski, Raphael Tieulent, Jeno Kedi, Alexander E. Shevelev, Evgeniy M. Khilkevitch and Alexander N. Mokeev

Calibration Strategy for ITER XRCS-Survey
Sapna Mishra, Sanjeev Varshney and Robin Barnsley

11th Asian Conference on Applied

Superconductivity and Cryogenics / 3rd Asian International Cryogenic Materials Conference, Shanghai, China, 29th October to 01st November 2023

Development and Validation of Steady-State and Transient Simulation Code of a tube-in-tube Heat Exchanger Unit for Cryogenic Process Simulator
Vinit Shukla

65th Annual Meeting of the APS Division of Plasma Physics, Colorado, USA, 30th October – 03rd November 2023

Observation of sub-sonic plasma flow in a nonuniform magnetic field in the Helicon Plasma device
Mariammal M, Renu Bahl, Narendar Singh, Ramesh Kumar Buddu, Prabal Kumar Chattopadhyay

Experimental Investigation of Orbital Debris Soliton Generation
Bill E Amatucci, Erik M Tejero, Ami M DuBois, Carl L Enloe, David D Blackwell, Chris E Crabtree, Guru Ganguli, Abhijit Sen

Zonal Flows in ADITYA-U tokamak
Kaushlender Singh, S. Dolui, B. Hegde, A. Kumawat, Ankit Kumar, Tanmay Macwan, H. Raj, Sharvil Patel, Nandini Yadava, Abha Kanik, Kajal Shah, Pramila Gautam, Rohit Kumar, Suman Aich, Laxmikanta Pradhan, Ankit Patel, Kalpesh Galodiya, Raju Daniel, S.K. Jha, K.A. Jadeja, K.M. Patel, Shwetang Pandya, L.T. Lachhvani, M.B. Chowdhuri, R.L. Tanna, P.K. Chattopadhyay, R. Pal, A. Sen, J. Ghosh

Study of confined runaway electrons in ADITYA-U Tokamak
Suman Dolui, Kaushlender Singh, Harshita Raj, Tanmay Macwan, Ankit Kumar, Bharat Hegde, Ashok Kumawat, Rohit Kumar, Suman Aich, K.A. Jadeja, K.M Patel, Laxmikanta Pradhan, Shishir Purohit, Minsha Shah, A.N. Adhiya, R.L. Tanna, J. Ghosh

7th International Conference on Nanostructuring by Ion Beams (ICNIB 2023), UPES University, Dehradun, 2-4 November 2023

Facet evolution on Si surfaces under low energy Xe ion irradiation: Influence of ion beam parameters
Sukriti Hans, Mukesh Ranjan

28th International Conference on Nuclear Tracks & Radiation Measurements (ICNTRM-23), Gurugram, Haryana, 6-10 November 2023

Evolution of Triangular Features on Si Surfaces under Low-Energy Ar Ion Irradiation
Sukriti Hans, Mukesh Ranjan

7th Asia-Pacific Conference on Plasma Physics (AAPPS-DPP2023), Nagoya, Japan, 12-17 November 2023

Trapping of wave in a flowing dusty plasma
Krishan Kumar, Pintu Bandyopadhyay, Swarnima Singh, Abhijit Sen

Characteristics of APPEL Device Long Magnetized Plasma Column Produced Using Hollow Cathode Plasma Source
Y. Patil, S. K. Karkari

High Resolution Visible Imaging Based Plasma Boundary Realization for Aditya-U Tokamak Operations
S.K. Gupta, S. Purohit, Vishnu Chaudhari, M.K. Gupta, M. Chavda, K. Patel, K.A. Jadeja, K. Tahiliani, S. Kumar, S.A. Nair, R.L. Tanna, J Ghosh, S.K. Pathak, and ADITYA-U

ECR assisted ICRF plasma production in ADITYA-U tokamak
K. Mishra, J. Ghosh, K.M. Patel, K.A. Jadeja, S. Kumar, H.M. Jadav, R. Kumar, R.L. Tanna, K. Singh, H. Raj, B. Kadia, K. Parmar, M. Singh, N. Ramaiya, M.B. Chowdhuri, S. Aich, R. Joshi, D. Rathi, A. Varia, R.P. Yadav, G. Ashok, B. Hegde, A. Kumawat

COMSOL Conference 2023, Bengaluru, 30 November 2023 - 1 December 2023

2D Transient Magnetic Field analyses of Linear Induction Motor
Ananya Kundu, Pedada Prasada Rao, Y.S.S. Srinivas, Vilas C. Chaudhari, Arvind Kumar, Ankur Jaiswal, Anita Patel, E.Rajendra Kumar

Electromagnetic Analyses for Indian Tokamaks SST-1 and ADITYA
Amardas Alli

38th National Symposium on Plasma Science and Technology (Plasma-2023), UPES, Dehradun, 4-8 December 2023

Collective Charged Dust Dynamics in Spatially Diffused Plasma
Sanat Tiwari, Sachin Sharma, Meenakshee Sharma, Prabhakar Srivastav, and Yogesh Saxena

Plasma Technology for Degrading Organic Impurities in Artificial Wastewater
Vikas Rathore, Shruti Patel, Akanksha Pandey, Jignasa Savjani, Shital Butani, Heman Dave, Sudhir Kumar Nema

Experimental Studies on Impact of Magnetic Islands on Electron Heat and Runaway Electron Transport in Aditya/Aditya-U Tokamak
S. Patel, J. Ghosh, M. B. Chowdhuri, K. B. K. Mayya, R. L. Tanna, K. Singh, S. Dolui, A.Kumawat, B. Hegde, A. Kumar, T. Macwan, S. Aich, H. Raj, R. Kumar, K. A.Jadeja, A. Kanik, N. Yadava, I. Hoque, S. Banerjee, K. Yadav, D. Modi, K. M. Patel,N. Ramaiya, R. Manchanda, H. K. Pandya, V. Kumar, . Joisa, D. Raju, S. Jha, S. Purohit, P. K. Atrey, S. K. Jha, C. V. S. Rao, P. Vasu, D. Chenna Reddy, S. B. Bhatt, and Y. C. Saxena

Investigation of Steady-State and Dynamic Sheaths around Cylindrical Wire Probes
Pawandeep Singh, Prince Kumar, Swati Dahiya, Shantanu Karkari

Investigations of Magnetically Screened Plasma in LVPD-Upgrade
Ayan Adhikari, A. K. Sanyasi, L. M. Awasthi, P.K. Srivastava, Mainak Bandyopadhyay, and Devendra Sharma

Unravelling the Influence of Fluid Helicity on MHD Dynamo Action
Shishir Biswas, Rajaraman Ganesh

Impact of the Impurity Seeding Over the Runaway Electron for the Aditya-U Ohmic Plasma
S. Purohit, M.B. Chowdhuri, M.K. Gupta, S. Kumar, K. A. Jade, K. Patel, U. Nagora, K. Tahiliani, S. A. Nair, R. Tanna, J. Ghosh S. K. Pathak and Aditya-U Team

Advancing Plasma Current Measurements in the Aditya-Upgrade Tokamak Utilizing a Twisted Optical Fiber Based Magneto-Optic Current Sensor (MOCS)
Santosh P. Pandya, Kumudni Tahiliani, I. Suresh, Akash Shiroya, Jahanvi Lalwani, Praveenlal E.V., Sameer Kumar Jha, Lavkesh T. Lachhvani, Suman Aich, Laxmikanta Pradhan, Rohit Kumar, Surya Kumar Pathak, Rakesh Tanna, Joydeep Ghosh and Aditya-Upgrade tokamak team

Beam Driven Electromagnetic Instability in High Temperature Plasma
Anjan Paul, Devendra Sharma

Hydrogen- Deuterium Gas Mixture Cryosorption and Separation Studies On Zeolite 13x for Application in Cryogenic Molecular Sieve Bed Adsorber System
V. Gayathri Devi, Deepak Yadav, Aravamudan Kannan, Pragnesh Dorajia, Rajendra Bhattacharya, Amit Sircar

Design of ITER Cryostat Upper Cylinder Alignment Tools in Tokamak Pit and Its Validation with Finite Element Analysis
Vipul More, Girish Gupta, Manish Kumar Pandey1, Saroj Kumar Jha, Rajnikant Prajapati, Anil Kumar Bhardwaj, Umesh Tilwani, Dipen Shah

A Novel Method of ECR-Assisted ICRF Plasma Production and Its Application for Low Voltage Ohmic start-Up In Aditya-U Tokamak
Kishore Mishra, J. Ghosh, Sunil Kumar, R. Tanna, H M Jadav, K.S. Shah, Rohit Kumar, K. M. Patel,K. A. Jadeja, N. Ramaiya, M.N. Makwana, Shivam Gupta, B. Kadia, K. M. Parmar, M. Singh, R.Joshi, D. Rathi, A. Varia, R. P. Yadav, G. Ashok, K. Singh, H. Raj Abhijeet Kumar, M. B.Chowdhuri, S. Aich, B. Hegde, A. Kumawat and Aditya-U team

Installation and Commissioning of the Experimental Helium Cooling System at IPR
B. K. Yadav, A. Gandhi, A. Saraswat, S. Verma, P. Chaudhuri

Study of Tungsten Carbide and Tungsten-Rich Tungsten Carbide Films Deposited at Different Substrate Temperatures
Shristi Bist, Ratnesh K. Pandey, Sejal Shah, Parswajit Kalita, S. Sen, D. K. Avasthi

Nanoparticle Dynamics and Residual Charge in Afterglow Nanodusty Plasma
Bidyut Chutia, Y. Bailung, T. Deka, S. K. Sharma, and H. Bailung

Plasma Boundary Simulations of Limiter Ramp-Up Phase of ITER
Arzoo Malwal, Devendra Sharma, Richard A. Pitts

Development of Capacitive Coupled Radio Frequency Discharge Plasma Device for the Validation of Super Sonic Molecular Beam Diagnostics
Varsha S, Prabhakar Srivastav, Milaan Patel, Vishnu Chaudhari, Amit Kumar and Jinto Thomas

Development of Double Differentiator Circuit with Varying Cut off Frequency for Measurement of Electron Energy Distribution Function
Bhoomi Khodiyar, P K Chattopadhyay

Potential Measurement Using Laser Heated (Oxide Coated Cathode) Emissive Probe
A. K. Sanyasi, P. K. Srivastava, Ayan Adhikari, and L. M. Awasthi

Integrated Power Supply System for Large Volume Plasma Device- Upgrade (LVPD-U)
P. K. Srivastava, A. K. Sanyasi, Ayan Adhikari R. Sugandhi and L.M Awasthi

High Power Microwave Coupling and Trigger Synchronization Scheme for Microwave – Plasma Interaction Experiments in Symple
Priyavandana J.Rathod, Khirendra Pradhan and Anitha V. P.

Effect of Ion-Neutral Collision and Surface Produced Negative Ions on the Plasma Sheath
S. Samanta, R. Moulick, P. J. Bhuyan and B. J. Saikia

Experimental Estimation of Power Loss in The form of Fast Neutrals Escaping Out of Aditya Tokamak Using The Data Acquired on Energy Channels of Charge Exchange Diagnostics
Kumar Ajay, Santosh P. Pandya and Snehlata Aggarwal

Interaction of Elongated Whistler Waves with Null Region: Laboratory Setup and Preliminary Results
Ambesh Kumari, Om Raval, and G Ravi

Macroscopic Gradient Driven Electrostatic Instability in Linear Magnetised Plasma Column
Tanmay Karmakar, Rosh Roy and P K Chattopadhyay

Charged Particle Motion in E × B Fields in a Cylindrical Capacitor – An Inception of Plasma Mass
Separation
Manu Bajpai, Kaushik R. Patel, Mainak Bandyopadhyay

Droplet Shaped Multi-Layer Plasma Fireball formation in Magnetically Constricted Anode
Prashant K. Barnwal, Vivek Pachchigar, Mukesh Ranjan

Magnetic Field-Driven Transitions in Low-Pressure Ccrf Discharge: A Way to Enhanced Plasma Control
Swati Dahiya, Pawandeep Singh, Sarveshwar Sharma, Nishant Sirse, Shantanu K. Karkari

Non-Linear Interaction between Harmonics of Diocotron Modes in Partially Toroidal Electron Trap
Smartex-C
Kunal Singha, Nikhil Mohurle, Lavkesh Lachhvani, Rajiv Goswami, Sambaran Pahari, and Prabal K. Chattopadhyay

Development of Mach Probe for the Ion Flow Measurement in the Helicon Plasma System
Mariammal Megalingam, Renu Bahl, Narendar Singh, Ramesh Kumar Buddu, Prabal Kumar Chattopadhyay

Study of the Plasma Parameter Variation in Helicon Plasma Source in Oxygen Discharge by Global Model
N. Sharma, D. Dutta, M. Chakraborty, N. K. Neog, A. Mukherjee, M.Bandyopadhyay

Study of an Atmospheric Pressure Plasma with OES
P. P. Kalita, A. Ahmed, S. Singha, P. Baruah, N. K. Neog, T. K. Borthakur

Electron Energy Distribution Function Measurements in a Radio Frequency Discharge Using an RFcompensated Langmuir Probe and Second Harmonic Technique
Akanshu Khandelwal, Swati Dahiya, Pawandeep Singh, Dhyey Raval, Yashshri Patil, S.Karkari, and Nishant Sirse

Absorption of an Ultrashort Light Pulse in Short Scale Length Inhomogeneous Plasmas
Mamta Yadav, Anjana K P, Mrityunjay Kundu and Sudip Sengupta

Simulation of Nonlinear Oblique Whistler Wave in Low- Density Space Plasma and High-Density Laboratory Plasmas
Gayatri Barsagade, Devendra Sharma

Study of Equilibrium at the Magnetosphere-Plasma Boundary in Accreting Neutron Stars
Anoop Singh, Mrityunjaya Kundu, and Shishir P. Deshpande

Impact of Plasma Sterilization: Studies on

Probable Biochemical Actions and Mechanisms for Bacterial Inactivation
Tejal Barkhade, Kushagra Nigam, G. Ravi, Seema Rawat and Sudhir Kumar Nema

Study of Diffusion of Argon in Ambient Air from Plasma Jet
Akshay Vaid, G.Ravi, Subroto Mukherjee

Study the Effect of Plasma Carburizing Process on Tribological Properties of Titanium Alloy
Ghanshyam Jhala, Akbar Basha, Vijay Chauhan and Alphonsa Joseph

Generation of Dielectric Barrier Discharge Plasma on Large Area Electrode at Atmospheric Pressure for Agriculture Applications
Anand Visani, Ramkrishna Rane, Akshay Vaid, Rohit Parihar, Parmesh Maila, Alphonsa Joseph

A Comparative Study of Morphological, Structural and Magnetic Properties of Iron Oxide Nanoparticles Synthesized By Magnetically Enhanced Thermal Arc Plasma Process
Savita, Subrat Das, Prachi Orpe, Balasubramanian C

Surface Modification of Polystyrene Flask Using Glow Discharge Plasma to Enhance Cell Adhesion
R. Rane, J. Parikh, P. Maila, R. Parihar, A. Vaid, A. Visani, C. Shah, A. Joseph

Design & Development of a Low Energy Plasma Immersion Ion Implantation (Piii) System and Preliminary Results
A. Satyaprasad, R. Rane, Razia, S. K. Gupta, S. Mukherjee, Alphonsa Joseph

Modification in the Surface Properties of Silicon Substrate by NF_3 RF Glow Discharge Plasma
Vrushank Mehta, H. L. Swami, Rajesh Kumar

Plasma Spray Coating of Cr_2O_3 and Its Characterization
K.P Singh Sunil Belsare, Kedar Bhope, Priyanka Patel, Nikunj Patel, Prakash Mokaria, Samir S Khirwadkar

Air Oxidation Study of TiN and TiALN Coating Deposited on Stainless Steel Tube Using Plasma Assisted Cylindrical Magnetron Sputtering
Kunal Trivedi, Ramkrishna Rane, Alphonsa Joseph

Development of Civil Infrastructure Facility for Testing, Commissioning and Transfer of Plasma Based Industrial Technologies of Societal Benefit Project
Alok B Nachiketa, Vijay Bedakihale, Chandrasinh Chauhan, S Nema, Alphonsa Joseph, S Mukherjee, S. Chaturvedi

Study of Nitrogen Fixation in Organic Waste Using Non-Thermal Plasma
S.S. Kausik, Dipjyoti Baishya, Rupa Newar, Jintumoni Pathak, Nipan Das, and N.J. Saikia

Design of Soft X-Ray Diagnostic with Provision for Various Filter Thickness Combinations
A. Adhiya, A. Kumar, M. K. Gupta, S. Purohit, N. Kadamdhad, S. Tripathi and S. K.Pathak

Characterization of VUV Survey Spectroscopy System Installed On Aditya-U Tokamak
Vishal Sharma, M. B. Chowdhuri, Sharvil Patel, Nilam Ramaiya, Dipexa Modi, Gajendra Singh, Ranjana Manchanda, S. K Pathak, Joydeep Ghosh, and Aditya-U

Challenges in High-Resolution Visible Imaging Diagnostics: Shutter Closure and False Trigger Issues
In Aditya-U Tokamak
Suraj Kumar Gupta, Maatang Chavda, Vishnu

Chaudhari, Manoj Kumar

High-Resolution Visible Imaging for Ohmic Plasma Start-Up of Aditya-U Tokamak
M. Chavda, S.K. Gupta, S. Purohit, M.K. Gupta, S. Kumar, M.B. Chowdhuri, S. A. Nair, R. Tanna, J. Ghosh, S. K. Pathak and Aditya

Radial Profile of Ion Temperature from Low and High Field Sides of Aditya-U Tokamak Plasma
Roshin Raj Sheeba, M. B. Chowdhuri, J. Ghosh, Nandini, Yadava, Ankit. Kumar, A. Gauttam, Vishal Sharma, Sharvil. Patel, Dipexa Modi, Gajendra Singh, R. Manchanda, R. L. Tanna, S. K. Pathak, and Aditya

Measurement of C^{+1} Ion Toroidal Rotation Velocity Using Near- Infrared Spectroscopy in Aditya-U Tokamak
Nilam Ramaiya, Malay Bikas Chowdhuri, Aman Gauttam, Ankit Kumar Vishal Sharma,Nandini Yadava, Sharvil Patel, Dipexa Modi, Gajendra Singh, R. Manchanda, S. K .Pathak, K. A. Jadeja, K. M. Patel, R. L. Tanna, J. Ghosh, and ADITYA-U team

Design and Development of Opto-Mechanical Subsystems for Vuv Spectroscopic Diagnostics On Tokamaks
Manish Rathor, M. B. Chowdhuri, Aman Gauttam, Nandini Yadava, Sharvil Patel, Nilamramaiya, Dipexa Modi, Gajendra Singh, R. Manchanda, Joydeep Ghosh, and S. K. Pathak

Electron Temperature Measurement in Aditya-U Edge Plasma Region Using Spectral Line Ratio of Argon
Aman Gauttam, M. B. Chowdhuri, Ankit Kumar, Sharvil Patel, Nandini Yadava, Nilam Ramaiya, Dipexa Modi, Gajendra Singh, Manish Rathor,R. Manchanda, K. A. Jadeja, K.M. Patel, R. L. Tanna, Joydeep Ghosh, and S. K. Pathak, and ADITYA-U team

Improving the Performance of Thomson Scattering Detection System for SST-1
Vishnu Chaudhari, Neha Singh, Pk Mishra, Amit Kumar, Janvi Dave, Vishal Kushwah and Jinto Thomas

Investigation of Radial Profile Hα Emission from Impurity Seeded Aditya-U Plasmas
Dipexa Modi, M. B. Chowdhuri, J. Ghosh, Ankit Kumar, Aman Gauttam, Ritu Dey, S.Patel,N. Yadava, N. Ramaiya, Gajendra Singh, Manish Rathor, R. Manchanda, K. A. Jadeja, K. M. Patel1, R. L. Tanna, and S. K. Pathak, and Aditya-U Tokamak

Effect of Density & Impurity Seeding On Edge Toroidal Rotation in Aditya-U Tokamak
Ankit Kumar, K. Shah, Aman Gauttam, M.B. Chowdhuri, N. Yadava, S. Patel, G. Shukla,R.L. Tanna, Nilam Ramaiya, K. A. Jadeja, Kaushlender Singh, Bharat Hedge, Sumandolui, Ashok Kumawa, Soumitra Banerjee, Injamul Hoque, Komal, A. Kanik, P.Gautam, Laxmikanta Pradhan, K. M. Patel, Ankit Patel, Dipexa Modi, Harshita Raj, Suman Aich, Rohit Kumar, M. Shah, Kalpesh Galodiya, Joydeep Ghosh

Design, Calibration and Results from Retarding Field Energy Analyser (RFEA) Probe for Aditya-U Tokamak
Bharat Hegde, S. Dolui, Ashok Kumawat, Ankit Kumar, K. Singh, I. Hoque, S.Banerjee, K. Yadav, H. Raj, Pramila Gautam, Nilam Ramaiya, Sharvil Patel, Abhakanik, K. A. Jadeja, Rohit Kumar, Suman Aich, Laxmikanta Pradhan, Ankit Patel,Kalpesh Galodiiya, Shwetang N. Pandya, K.M. Patel, R.L. Tanna, and J. Ghosh

Installation and Testing of Fast Magnetic Probes in Aditya-U Tokamak
Komal, H. Raj, A. Kumawat, I. Hoque, S. Banerjee, B. Hegde, A. Kanik,K.Singh,A. Kumar, S. Dolui, R. Kumar, S. Aich, S. Patel, . Kundu, K.M. Patel, K.Galodiya, K. A Jadeja, Laxmikanta Pradhan, Ankit Patel, R.L. Tanna, J. Ghosh

Commissioning and Testing of -55kV, 110A High Voltage Power Supply (EC-MHVPS) for 42 GHz ECRH System
Jatinkumar Patel, K.G. Parmar, H. Mistry, H. Patel, D. Purohit, B.K.Shukla, Sandip Gajjar, Rasesh Dave, Ronak Shah, D. Upadhyay, K. Mehta, N. Goswami, N.P. Singh

Commissioning of PXI & PLC Data Acquisition & Control (DAQ) System for ICRH System (35-65 MHz RF Amplifier) at SST1- Tokamak
Manoj Singh, HM Jadav, Sriprakash Verma, Kumar Rajnish, Ramesh Joshi, Dipal Soni, Bhavesh Kadia, Kirit Parmar, Kishore Mishra, Rana Pratap Yadav, Dharmendra Rathi, Atul Varia, Sunil Kumar

Different Configurations High Power Ramp Signal for Use in Electric Probe Plasma Diagnostics
Karishma Qureshi, Paresh Patel, Pramila Gautam, L. K. Bansal, Sanjay Parmar and U. K.Baruah

In House Design and Development of The FPGA Based Eight Channel Programmable Trigger System for Triggering the Fast-Reciprocating Langmuir Probe System.
Abhijeet Kumar, Kaushlender Singh, Praveenlal E V, Bharat Arambadiya, Hitesh Mandaliya Rachana Rajpal, Joydeep Ghosh

Inhouse Development of FPGA Based PCIE Multifunction Data Acquisition and Control Card for Real-Time Control System Applications
K Patel, K Mahajan, A Sharma, J Patel, V Patel, M Bhandarakar, H Masand, I Mansuri, H Chudasma, Priyadarshini, T Rao

Hydrogen- Deuterium Gas Mixture Cryosorption and Separation Studies On Zeolite 13x for Application in Cryogenic Molecular Sieve Bed Adsorber System
V. Gayathri Devi, Deepak Yadav Aravamudan Kannan, Pragnesh Dorajia, Rajendra Bhattacharya and Amit Sircar

Labview Based Data Acquisition Using Epics Process Variable for ICRH DAC
Ramesh Joshi, H M Jadav, Sunil Kumar and High Power ICRH Systems Division

On-The-Fly Training Architecture for Time Series Neural Network on Aditya/Aditya-U Data
Ramesh Joshi, Joydeep Ghosh, Nileshkalani, Sunil Kumar and R. L. Tanna

Multichannel Electronics for SXR Diagnostic in Aditya-U Tokamak
Praveena Kumari, Rachana Rajpal, Asha Adhiya, Manoj Kumar Gupta and Joydeep Ghosh

A GUI Based Property Package for Helium, Nitrogen, n-Hydrogen, p-Hydrogen Fluids
Vinit Shukla, Aafaq Alam, Nitin Shah, Hitensinh Vaghela, Parthasarathi Ghosh

Design & Development of Fast Switching Series Switch for SGPS of Diacrode Based RF Amplifier
Hrushikesh Dalicha, Kartik Mohan, Gajendra Suthar, Raghuraj Singh, Rajesh Trivedi

Python Based Prototype DAQ Application for Cryogenics Experiments
Rakesh Patel and Vipul Tanna

Development of 22kV, 50mA High Voltage Dc

Power Supply for Plasma Experiments of Outreach Division
Kirit Parmar, Bhavesh Kadia, YSS Srinivas, Harsha Machchhar, Sunil Kumar and High Power ICRH Systems Division

Characterization of Sorbents for Cryopumping in Fusion Devices and Other Large Scale Pumping Application
J. Mishra, R. Gangradey, P. M. Panchal, S. Mukherjee, P. Nayak, V. Gupta, H. Agravat, M. Banaudha

Design of Hysteresis Band Current Controller Using DSP for Fast Response Bipolar Power Supply
Praveenlal Edappala, Rachana Rajpal, Amit Ojha and Dinesh Sharma

Steady State Performance Test Results of PINI Ion Source Back Plate and Comparison with 3D CFD Simulation
Mukti Ranjan Jana

PLC-Based Automatic Black Body Heating Control System
Vismaysinh Raulji, Bharatkumar Arambhadiya, Rachana Rajpal, Varsha Siju, Karishma Pandya, Praveena Shukla, S. K. Pathak and Subroto Mukherjee

Development of A Pulsed Power Driver for Operating A Tube Shaped Inertial Electrostatic Confinement Fusion Device
S. Kalita, N. Bharali, L. Saikia, M. K. D. Sarma, S. R. Mohanty

Readiness of Test Auxiliary Cold Box for Magnetic Cryogenics Test Bench at ITER Site
Bikash Dash, Vinit Shukla, Vikas Gaur, Anuj Garg, Jotirmoy Das, Himanshu Kapoor, Pratik Patel, Nitin Shah

Performance of an Inertial Electrostatic confinement Fusion Device Having a Multi-Grid Configuration
L. Saikia, N. Bharali, S. R. Mohanty, S. Adhikari

PLC Based Ladder Logic for Control, Monitoring and Interlocks of 100kW, 35-46 MHz ICRH DAC System
H M Jadav, Ramesh Joshi, Manoj Parihar, Sunil Kumar and High Power ICRH Systems Division

Conceptualisation of Cryostat Useful for Testing of 3t-Hps Magnets and Other Plasma Experiments
Prabal Biswas, Sudhir Tripathi, Mahesh M. Ghate,Manoj K. Gupta Swadesh Patnaik,Snehal Jayswal, Deven Kanabar, Piyush Raj, Swati Roy, Pankaj Varmora, Upendra Prasad

Up Gradation of Neutral Grounding System for 14 Nos. of Distribution Transformers
Prakash Parmar, Chandra Kishor Gupta, Supriya Nair, Chirag Bhavsar

Development of Cooling Water Distribution System for Twin Source Test Facility
Ravi. Pandey, Mainak Bandyopadhyay, M.J. Singh, and A. Chakraborty

Development of PLC & SCADA Application for HTS Current Leads Test
G. Mahesuria, R. Patel, R. Panchal, P. Panchal, N. Bairagi, D. Christian, A. Garg, D. Sonara, H. Nimavat, GLN Srikanth and V.L. Tanna

Development and Testing of a Pneumatic Mechanical Punch for Application in Cryogenic Pellet Injection
Paresh Panchal, J S Mishra, Hemang Agravat, Samiran Mukherjee, Moni Banaudha, Ranjana Gangradey

Design, Development and Testing Results of Controller for Fast Response Bipolar Power Supply
Murtuza Vora, Dinesh Kumar Sharma, Akhilesh Singh, Amit Ojha, Supriya A Nair

Design, Fabrication, Assembly, Testing, and Commissioning of the Beamline Components for Ion Beam Neutralization Experiments in Robin
K. Pandya, M.J. Singh, R.K. Yadav, V. Mahesh, R. Pandey, H. Mistri, B. Prajapati, M. Bhuyan, S. Dash, J. Bhagora, A. Gahlaut, M. Bandyopadhyay, and A. Chakraborty

Installation & Commissioning of Cooling Water System for LLMHD at IPR
M. Vasani, S. K. Sharma and R. Mishra

Challenges Faced & Resolved During Readiness of Test Auxiliary Cold Box

Vikas Gaur, Vinit Shukla, Bikash Dash, Anuj Garg, Himanshu Kapoor, Pratik Patel, Jotirmoy Das, Nitin Shah

Development of CG DE-Coupling Capacitor for 120kW RF Amplifier
Sunil Dani, Akhil Jha, Rohit Anand, Gajendra Suthar, Manoj Patel, Kartik Mohan, Hrushikesh Dalicha, Paresh Vasava, Ulhas Dethe, Raghuraj Singh, Sriprakash Verma, Dipalkumari Soni, Kumar Rajnish, Rajiv Sharma, and Rajesh Trivedi

Development of Human Machine Interface (HMI) Using CODAC Core System for Typical Auxiliary Cold Box (ACB)
Anuj Garg, Pratik Patel, Nitin Shah, Kumar Rajnish, Bikash Dash, Srinivasa Muralidhara, Marie Cursan, Riccardo Pedica, Hyun-Sik Chang, Hitensinh Vaghela

Conceptual Design of Capacitor Bank Based Pulsed Power Supply for Pre-Testing of Ohmic Coils of SST-1
C. Dodiya, A.Makwana, U. Prasad and V. Tanna

Ethernet Based Controller for Analog Signal Conditioning Electronics
Minsha Shah, Praveenlal E V, Rachana Rajpal

ITER In-Wall Shielding Block Assembly Sequences.Technical Challenges and Resolutions.
R Laad, S Padasalagi, S Dani, U Dethe, A Maheshwari, B Gajjar, M Patel, M Jindal, S.Singh, T Sharma, M.Shaikh, J. Raval, KSVV Prasad, D Francis

Development of Digital Control and Protection Schemes for Inverter Section of Fast Response Bipolar Power Supply
Amit Ojha, Dinesh Sharma, Murtuza Vora, Akhilesh Singh, Praveenlal Edappala, Supriya A. Nair

Design of ITER Cryostat Upper Cylinder Alignment Tools in Tokamak Pit and Its Validation with Finite Element Analysis
Vipul More, Girish Gupta, Manish Kumar Pandey, Saroj Kumar Jha, Rajnikant Prajapati, Anil Kumar Bhardwaj, Umesh Tilwani, Dipen Shah

Installation and Alignment Study of CW Dummy Load for 1 MW at 170 GHz Gyrotron
Amit Yadav, Vipal Rathod, Deepak Mandge, Sharan E Dilip, Ronak Shah, Anjali Sharma, Rajvi Parmar & S. L. Rao

Porosity Measurement of Different Grades of Highdensity Graphite
Arunprakash Arumugam, Aroh Shrivastava, D.C. Raval and Ziauddin Khan

Improvisations & Interface of 3-Tier 60kV Ignitron

Based Crowbar System for 1MW, 170GHz, 1000S Gyrotron System Pulse Power Network
E. Sharan Dilip, Shk Madeena Valli, Vipal Rathod, Ronak Shah, Rajvi Parmar, Deepak Mandge, Amit Yadav, Anjali Sharma, N.P. Singh and S.L. Rao

Testing and Integration of a Large-Area X-Ray Hybrid Photon Counting Detector for ITER X-Ray Spectrometers
Deepak Mandge, P Bharathi, Sanjeev Varshney, Kumar Rajnish, Sapna Mishra, Abha Maheshwari, Bhoomi Gajjar, Pratik Vaghashiya and Hitesh Pandya

Implementation of Pre-Fill Pulse Control Model for Aditya-U Tokamak
Kiran Patel, Umesh Nagora, K.A. Jadeja, K.M. Patel, Jinto Thomas, Surya Pathak

Safety System Realization Using Key-Lock Architecture for ITER ICRH System
Kartik Mohan, Gajendra Suthar, Hrushikesh Dalicha, Rohit Anand, Raghuraj Singh, Dipal Soni, Kumar Rajnish, Rajesh Trivedi

Development of 20kV, 50mA High Voltage DC Power Supply with Capacitor Charging and Discharging To the Plasma Gun Experiments
Bhavesh Kadia, Kirit Parmar, Ravi Ranjan, Yashashri Patil, Shantanu Karakari, Sunil Kumar and High Power ICRH Systems Division

Calibration and Power Measurement Experiments for 95 GHz Water Cooled Dummy Load
Hardik Mistry, Harshida Patel, Nani Medicherla, P Srikrishnab, Jatin Patel, Dharmesh Purohit, K G Parmar, Santanu Karmakar & B. K. Shukla

Centralized Energy Monitoring System for LT Electrical Distribution
Jignesh Patel, Hitesh Chudasma, Chirag Bhavsar, G. K. Rajan, Prakash Parmar, Vishnu Patel, Atish Sharma, Harish Masand, Kirit Patel, Priyadarshini Gaddam, T Srinivas Rao, C. K. Gupta, Supriya Nair and Kirti Mahajan

Design Over View of Outer Rotor Permanent Magnet Passively Compensated Pulsed Alternator
Prasada Rao P, Rambabu Sidibomma, Ankur Jaiswal, Arvind Kumar, Ananya Kundu, Vilas C. Chaudhari, Y.S.S. Srinivas, E. Rajendra Kumar

Study of High Voltage Step-Up Transformers for Negative Ion Based Neutral Beam Injector Power Supply
Aritra Chakraborty, Amal S, Saurabh Kumar, Paul D. Christian, Ashok Mankani and Ujjwal Kumar Baruah

Development and Testing of Control System for Annealing of Optical Fiber Bundle
Shivakant Jha, Gheesa Lal Vyas, Kumar Rajnish, Pratik Vaghashiya, Hitesh Pandya

Enhancement of Robin DACS for Ion Beam Neutralization Experiments in Robin
R.K. Yadav, H.Mistri, J. Bhagora, K. Pandya, V. Mahesh, B. Prajapati, M. Bhuyan, A. Gahlaut, R. Pandey, M. Bandyopadhyay, M.J. Singh, and A. Chakraborty

A Novel Vacuum Set Up for the ITER High Resolution X-Ray Edge Spectrometer
Bhargav Choksi, P Bharathi, Siddharth Kumar, Avik Bhattacharya, Raphael Tieulent, Philippe Bernascolle and Hitesh Pandya

Spectroscopic Study of Recent Ion Beam Extraction Experiments on SST-1 NBI Test Stand
P.Bharathi, Bhargav Choksi,V.Prahlad, S.K.Sharma, M.R Jana, Ch.Chakrapani, B.Sridhar, L.K.Bansal, Karishma Quereshi, Vijay Vadher,

L.N.Gupta, Dipal Thakkar, C.B.Sumod, Sanjay Paramar, Nilesh Contractor, Paresh Patel and Ujjwal Baruah

Theoretical Investigation of Intensity Ratio of Spectral Lines at 18.79 nm and 18.03 nm of Ar^{13+} Ion Observed in Aditya-U Tokamak
Gajendra Singh, M. B. Chowdhuri, J. Ghosh, Aman Gauttam, Dipexa Modi, S. Patel, Nandini Yadava, N. Ramaiya and S. K. Pathak

Support Structure for Dc Power Supply Line
P.K. Chauhan, S. Das, M.K. Gupta, P. Leuva, Bhavesh.Kadia, K. Parmar, C. Sekhar, S. Sharma, S. Kumar, P.K. Sharma

Testing, Integration & Commissioning of Auxiliary Power Supply Units for 1mw Gyrotron Test Facility
Shk Madeena Valli, E. Sharan Dilip, Vipal Rathod, Deepak Mandge, Ronak Shah, Rajvi Parmar, Amit Yadav, Anjali Sharma and S.L. Rao

Operational Challenges Faced During the Operation of Liquid Lead Lithium Magnetohydrodynamics (LLMHD) Experimental Loop and Their Mitigation
A. Patel, S. Verma, A. Saraswat, A. Prajapati, A. Deoghar, H. Tailor, S.Gupta, A. Makwana, C. Dodiya, R. Bhattacharyay, U. Prasad

Testing Phases of Permeation Based Hydrogen Isotopes Sensor in Gas and Liquid Phase at IPR
Rudreksh B. Patel, Pragnesh Dhorajiya, Sudhir Rai, P. A. Rayjada, Amit Muniya, Amit Sircar, Ankush Deoghar, Rajendra Bhattacharyay, Paritosh Chaudhuri

Mounting and Testing of IGBT Driver Cards for Radial Field Control Coil (RCC) Power Supply
Akhilesh Kumar Singh, Dinesh Kumar Sharma, Murtuza M Vora, Amit Ojha, Kshitij Sharma, Krishna Mohan Kumar, Rahul Kumar Raj, Rohit Mishra, Ramesh Parmar, Supriya A Nair

Design, Development and Characterization of PID Based Silicon Carbide High Temperature Black Body Calibration Source for ECE Measurements
Abhishek Sinha, Dusmanta Mohanta, Neha Parmar, Surya K Pathak

Automated Labelling and Correlation Analysis of Diagnostic Signals from Aditya Tokamak for Developing Ai Based Disruption Mitigation Systems
J. Agarwal, N. Shah, S. Arora, B. Chaudhary, S. Jakhar, M. Sharma

Integration, Testing and Maintenance of Magnet Power Supply with Positive Neutral Beam Injector
Dipal Thakkar, Paresh Patel, Vijay Vadher, Sanjeev Sharma, Bhargav Chokshi, L.N.Gupta, Sumod C.B, L.K.Bansal, Karishma Qureshi, V Prahlad and U.K Baruah

Labview Based Data Acquisition and Control System Development for Remote Operation of Pellet Injector
M. Banaudha, J. Mishra, P. Panchal, S. Mukherjee, P. Nayak, V. Gupta, H. Aggravat, R. Gangradey

Finite Element Simulation of Eddy Current Brake for High-Speed Helium Turbine
A. Amardas, A.K. Sahu, Atish Kumar Dehury, Raj Singh

Electromagnetic Design and Analysis of 1 T HPS Solenoid Magnet
Devenkumar Kanabar, Mahesh Ghate, Piyush Raj, Swati Roy, Upendra Prasad, Vipul Tanna

A Comparative Analysis for Parallel Operation of Semiconductor Devices Used in High Current Applications for Tokamaks

Vaibhav Ranjan, Shivam Kumar Gupta, M N Makwana, Supriya Nair

Comprehensive Thermal Modeling and Analysis of Insulated Gate Bipolar Transistors (Igbts) in Highfrequency Inverters for High Voltage Power Supplies in Nuclear Fusion Experiments
Kumar Saurabh, Ashok Mankani, Aritra Chakraborty, Amal S, Paul Christian, Aditya Naugraiya, and Ujjwal Kumar Baruah

Derivation of Decelerator Grid Biasing Voltage from Beam Current of Positive Neutral Beam Injector (PNBI)
L.N. Gupta, Paresh J Patel, N.P Singh, L.K.Bansal, Karishma Qureshi, Sanjeev Sharma, M.R.Jana, Dipal Thakkar, Sumod C.B, Vijay Vadher V. Prahlad and U.K Baruah

Design, Development & Experimental Study of Cryo-Cooler Based Cryo-Panel Test Facility for Fusion Grade Cryo-Pump
P. Nayak. S. Mukherjee, R. Gangradey, V. Gupta, P. Panchal, J. Mishra H. Agravat, M. Banaudha

Installation and RF Characterization of LHCD System Transmission Line Components for Aditya-U
K. K. Ambulkar, P. R. Parmar, A. L. Thakur, C. G. Virani, P. K. Sharma

Experimental Testing of Solid-State Switch Based Quench Protection System for HPS Magnet
Swati Roy, Deven Kanabar, Arvind Kumar, Bhagyashri Thombare, Piyush Raj, Mahesh Ghate, Anees Bano, Dhaval Bhavsar, Upendra Prasad, Vipul Tanna

Studies of Hydrogen Retention and Recycling in Aditya-U Plasma Discharges
K.A.Jadeja, J.Ghosh, K.M.Patel,R.L.Tanna, Kiran Patel, A. B. Patel, B.G.Arambhadiya, K. D. Galodiya, Rohit Kumar,Harshita Raj, Suman Aich, Laxmikant Pradhan, M.B. Chowdhuri,Sharvil Patel, N.Ramaiya, Kajal Shah, Dipexa Modik. Singh, S. Dolui, Ankit Kumar, Bharat Hegde, Ashok Kumawat, Minsha Shah,Vismay Raulji, Rachana Rajpal, U. Nagora, S.K. Pathak, Shishir Purohit, Manoj Kumar, Kumudni Assudani, Devilal Kumavat, K.S. Shah, M.N. Makwana, Shivam Gupta, Supriya Nair, Kishore Mishra, P.K. Chattopadhyay, B.R. Kataria

Regulated High Voltage Power Supply and Its Safety Protocols and Practices
Sumod C B, Paresh J Patel, Dipal Thakkar, L N Gupta, D V Modi and U K Baruah

Design of Prototype Pulsed Alternator
Rambabu Sidibomma, Prasad Rao Pedada, Arvind Kumar, Ankur Jaiswal, YSS Srinivas and E Rajendra Kumar

Structural Design for Motorized Sliding Radiation Shielding Door
S. Das, P.K. Chauhan, M.K. Gupta, V. Prajapati, M. Abhangi, S. Vala

Development of Cryogenic Heater for Cooling Power Measurement in Indigenous Helium Liquefier Plant of IPR
P. Singh, O. Chandratre, A. K. Sahu, H. Dave, V. Patel, H. Kavad, R. Bhatasana and N. Kumar

Performance of the Xenon Cryocondensation Pumps in the Vacuum Test Facility of the Gridded Ion Source
Sanjeev Sharma, Sanjay Parmar, Bhargav Choksi, Nilesh Contractor, Ayush Bhatt, Purv Hanspura, V. Prahlad and U.K.Baruah

The Effect of Coalescence Instability on the

Interaction between Two Blobs in Scrape-Off Layer Region of Tokamak Plasma
Souvik Mondal, N Bisai, and A. Sen

Temperature Data Logger for 22kv Hvps Transformers Using Avr Microcontroller
Kush Mehta, Niranjanpuri Goswami, Dishang Upadhyay, Rasesh Dave, Sandip Gajjar, Aruna Thakar, Hitesh Dhola, Darshan Parmar, Vikrant Gupta, Amit Patel, Bhavin Raval, N P Singh, Ujjwal Baruah

Design Consideration of Piping Layout inside the Cold Box of Indigenous Helium Plant in IPR
Omkar Chandratre, A K Sahu

Experimental Results of a 3.3 kA Rated MgB_2 superconducting Link with HPS Current Leads
N. Bairagi, V.L. Tannaa, H. Nimavat, D. Sonara, R. Panchal, A. Garg, G Mahesuria, R. Patel, D. Christian, P. Panchal, G. Purwar, U. Prasad, D. Raju

A Novel Technique for Runaway Electron Mitigation in Tokamaks
R.L. Tanna, J. Ghosh, L.N. Pradhan, S. Patel, Chetna Chauhan, Rohit Kumar, H. Raj, S.Aich, K.A. Jadeja, K.M. Patel, A. Patel, K. Galodiya, K. Singh, S. Dolui, Ankit Kumar, A.Kumawat, B. Hegde, M.N. Makwana, K.S. Shah, Shivam Gupta, S. Nair, A. Adhiya, S.Purohit, M.K. Gupta, N. Ramaiya, M.B. Chowdhuri, U.C. Nagora, S.K. Pathak, Santosh Pandya, S. Dutta, and Aditya-U Team

Development of Cavities for 120kW RF Amplifier through Indian Industry
Raghuraj Singh, Akhil Jha, Manoj Patel, Rohit Anand, Kumar Rajnish, Sriprakash Verma,Dipalkumari Soni, Gajendra Suthar, Kartik Mohan, Hrushikesh Dalicha, Paresh Vasava, Ulhas Dethe, Sunil Dani and Rajesh Trivedi

Determination of Coordinates of Toroidal Loop Current on Aditya-U
Sameer Kumar A, Kumudni Tahiliani A, Praveena Kumari A, Praveenlal Edappala A, I Suresha, Daniel Rajua, B, Rachna Rajpala, Surya Kumar Pathak A, B, Rohit Kumara, and Aditya-U Team

Conceptual Design of Cold Bore Cryostat for Testing of High Temperature Superconducting Magnets Up To 65 K
M. Ghate, D. Bhavsar, D. Kanabar, P. Raj, P. Varmora, S. Roy, U. Prasad, V. Tanna

Installation Aspects of MW High Volatage Power Supply
Niranjanpuri Goswami, Kush Mehpa, Dishang Upadhyay, Sandip Gajjar, Rasesh Dave, Hitesh Dhola, Aruna Thakar, Vikrant Gupta, Darshan Parmar, Amit Patel, Bhavin Raval, N P Singh, Ujjwal Baruah

Implementation of Ultrasonic Testing for Volumetric Examination of Very High Thickness Stainless Steel forgings During ITER Cryostat Manufacturing
Mukesh Jindal, Amit Palaliya, Vaibhav Joshi, Mitul Patel, Rajnikant Prajapati, Anil Kumar Bhardwaj, Girish Gupta, Sarath.S, S Sivakumar

In-House Activities on Development of Prototype Remote Handling Systems in IPR
Jignesh Chauhan, Naveen Rastogi, Manoah Stephen, Ravi Ranjan Kumar, Krishan Kumar Gotewal

Integration of Motorized Tuning System for Indigenously Developed 120kW High Power RF Amplifier
Dipalkumari Soni, Kumar Rajnish, Sriprakash

Verma, Gajendra Suthar, Kartik Mohan, Akhil Jha, Manoj Patel, Hrushikesh Dalicha, Paresh Vasava, Ulhas Dethe, Sunil Dani, Rohit Anand, Raghuraj Singh and Rajesh Trivedi

Development of -65kv, 40A High Voltage DC Power Supply for LHCD System
Saifali Sharma, P.K.Sharma, N.P. Singh, LHCD Group and ITER India Power Supply Group

Update on the Progress of Remote Handling and Robotics Technology Development in IPR
Krishan Kumar Gotewal, Naveen Rastogi, Manoah Stephen, Ravi Ranjan Kumar, Jignesh Chauhan

Enhancement of Flow in the Internal Liquid Nitrogen Distribution System of the Positive Neutral Beam
Sridhar Bonagiri, Chakrapani Chodimella, Ayush Bhatt, Bhargav Choksi, Nilesh Contractor, and Prahlad Vattipalle

Preliminary Design and Analysis of Carriage for Electromagnetic Launching (EML) System
Arvind Kumar, Prasada Rao, Ankur Jaiswal, Ananya Kundu, Vilas Chaudhari, YSS Srinivas, E. Rajendra Kumar

Layout of Piping & Instrumentation for Peripheral Equipment of Cold Box of Indigenous Helium Plant of IPR
Hitesh R Kavad, A K Sahu, R Bhatasana, O Chandratre, H Dave, V. Patel, N Kumar, P Singh, P Brahmbhatt

Development of Signal Conditioning Electronics for Strain Gauge Measurement
Bhadresh R Parghi, Pankaj Varmora, Upendra Prasad

Design and Analysis of the Extruder Type Pellet Injector
Vishal Gupta, Hemang S. Agravat, Samiran S. Mukherjee, Ranjana Gangradey

Cryogenic Experimental Set-Up for Test of 2-Stream Plate-Fin Heat Exchanger
Hitesh R Kavad, A K Sahu, A. Singh, R Bhatasana, H Dave, O Chandratre and N Kumar

Rotational and Vibrational Temperature Estimation Using Fulcher Lines for Robin Ion Source in Volume Mode
Manas Bhuyan, Mainak Bandyopadhyay, Mahendrajit Singh, Kaushal Pandya, P Bharathi, Bhavesh Prajapati, Hiren Mistri, Jignesh Bhagora, Ratnakar Yadav,Himanshu. Tyagi, Mahesh. Vuppugalla, Agrajit Gahlaut, and Arun Chakraborty

Test Results of Indigenously Made Friction Welded Dissimilar Metal Pipe Joints for Cryogenic Application
Rajnikant Bhatasana, A K Sahu, Hardik Vyas and B. Doshi

Thermo-Structural Design of Liquid Nitrogen Cooled Copper PF Coils for SST-1 Tokomak
Arvind Tomar, Azad Makwana,Swati Roy, Chirag Dodiya, Upendra Prasad, Daniel Raju

Manufacturing and Testing of Components of Cooling Water System for ITER-India Laboratory
Rakesh Ranjan, Dinesh Gupta, Rohit Agrawal, Lalit Sharma, Mehul Chodavadiya, Naresh Parmar, Shivakant Jha

Integration & Installation of In-Vessel Components of Aditya-U Vessel
K.M. Patel, K.A Jadeja, H. Raj, Komal, L. Pradhan,Arun Prakash, R.L. Tanna, J. Ghosh, Sameer Kumar Jha, Deepti Sharma, S. Aich, R. Kumar, Ankit Patel, K. Singh, S. Dolui, Ankit

Kumar, B. Hegde, Ashok Kumawat, Shwetang Pandya, Aditya

Design and Optimization of Collimator and Shielding Mechanism for Neutron Radiography
Sachin J. Prajapati, H L. Swami, Abhishek Saxena, Varun V Savadi, S. Vala, Rajesh Kumar

Conceptual and Engineering Design of Vacuum Thermal Shield Over Liquid Metal Loop Section for Potential Nuclear Fusion Application
P A Rayjada, V Mehpa, P Bawankar, S. Ranjithkumar, A Patel, R Bhattacharyay

Design of Overpressure Protection Device for ITER Safety Chilled Water System
Mohit Kumar, Ajith Kumar, Aditya Singh, Jinendra Dangi, Mahesh Jadhav, Nirav Patel

Development of Helium Refrigerator/Liquefier Plant, Suitable for Tokamak Fusion Devices: Present Status
Ananta Sahu, Haresh Dave, Omkar Chandratre, Hitesh Kumar Kavad, Rajnikant Bhatasana, Vishnu B. Patel, Prashant Singh, Nawratan Kumar, Priyanka Brahmbhatt

Study of Stored Energy and Confinement for Aditya-U Tokamak Plasma
S. Aich, T. M. Macwan, K. Galodiya, K. Singh, S. Dolui, B. Hegd, J. Ghosh, K.A. Jadeja, K.M. Patel, A. Patel, L.K. Pradhan, R.L. Tanna, Sharvil Patel, Abhijeet Kumar, H. Mandliya, Vismay Raulji, Praveenlal E. V., R. Kumar, A. Kumar, A. Kumawat, H. Raj and Aditya-U Team

Application of Charge-Exchange Neutral Particle Analyzer (CX-NPA) Diagnostic in Tokamak Research
Snehlata Aggarwal, Santosh P. Pandya, and Kumar Ajay

Study of Different Faults in Magnetic Coil Systems in Aditya-U Tokamak
Rohit Kumar, H. Raj, L. Pradhan, S. Aich, Kaushlender Singh, Suman Dolui, Ashok Kumar, Bharat Hegde, Ankit Kumar, Shivam Gupta, M. Makwana, K.Shah, K.M Patel, K.A. Jadeja,R.L Tanna, and J Ghosh

Effect of Static Linearization on Beat Frequency for K-Band Ultra-Fast Ultra Wide-Band FMCW Reflectometer for Aditya-U Tokamak
J.J.U Buch, and S.K. Pathak

Fast Visible Imaging Diagnostic for Inductively Driven Pellet Injector in Aditya-U Tokamak
Devilal Kumawat, Kumudni Tahiliani, Sk Pathak, Joydeep Ghosh, R.L Tanna, Sambaran Pahari, Paritosh Chaudhuri, Sameer Kumar, Malay B Chowdhuri, Umesh Nagora, Manoj Kumar, Rohit Kumar, Harshita Raj, Kumarpal Sinh Jadeja, Kaushal Patel, Suman Aich, P.K. Maurya, Adityanandan Savita, Neeraj Shiv, P. Rahulnath, Saroj Jha, K. Raghvendra, B. Nagaraju, Sukant Mahar, I.V.V. Suryaprasad, Subhadip Das Bharat Doshi, P.K. Chattopadhyay, A. Sen, Y. C. Saxena, R. Pal, S. Chaturvedi, Aditya-U and Barc Team

Development of Heat Extraction Facility for Extraction of Heat Load from Molten Pb-16li during Thermo-Fluid Lead Lithium Magneto Hydro Dynamic (LLMHD) Experiment
A. Deoghar, S. Verma, A. Saraswat, A. Prajapati, S.Gupta, D. Sharma, A. Patel Tailor, A. Gandhi, S.K. Sharma, R. Bhattacharyay

Installation and Commissioning of the Experimental Helium Cooling System at IPR
B.K. Yadav, A. Gandhi, A. Saraswat, S. Verma, P. Chaudhuri

Experimental Investigation and Validation of Heat

Transfer Coefficient in Circular Channels
Deepak Sharma, Maulik Panchal, Shrikant Verma, Sandeep Gupta, Paritosh Chaudhuri

Velocity Measurement of High Speed Moving Object Employing Photoelectric Sensor Based System for EML
Ananya Kundu, Prasada Rao, Yss Srinivas, Mohit Gupta, Ankur Jaiswal, Arvind Kumar, Ashok Kumar Kumawat, T.Srinivas Rao, Vilas C Chaudhari, Rambabu Sidibomma, E.Rajendra Kumar

Thermal Hydraulic Simulation of HCSB Blanket for HXTR Concept
Piyush Prajapati, S.P. Deshpande, P.N. Maya, H. L. Swami, D. Sharma

ITER EC MHVPS Layout Integration in PLM and Resolution of Interfaces to Accommodate the Layout within Allocated Confine Space
M Patel, S Gajjar, V Gupta, D Upadhyay N P Singh, S Padasalagi

Estimation of Flux Surface Profiles for SST-1 Plasma Discharges Using Neural Network Models
Udaya Maurya, Raju Daniel

Study of Plasma Current Density Profile at The (2,1) Mode Location with Short Gas Pulse Injection By Means of Fast Reciprocating Magnetic Probe System in Aditya-U Tokamak
Sk Injamul Hoque, K. Singh, S. Banerjee, S. Dolui, A. Kumawat, B. Hegde, A. Kumar, K. Yadav, H. Raj, R. Kumar, S. Aich, S. Patel, K. Shah, A. Kanik, Laxmikanta Pradhan, K. A. Jadeja, Ankit Patel, R.L. Tanna and J. Ghosh

A Statistical Investigation into Disruption Patterns & Location Identification in Aditya-U Tokamak
Soumitra Banerjee, Sk Injamul Hoque, K. Singh, S. Dolui, A. Kumawat, B. Hegde,A. Kumar, K. Yadav, H. Raj, R. Kumar, S.Aich, S. Patel, K. Shah, A. Kanik, Laxmikanta Pradhan, K. A. Jadeja, Ankit Patel, R.L. Tanna, and J. Ghosh

Conceptual Design of Data Acquisition System (DAS) Applicable for Linearly Travelling Magnetic Fields Devices
Harish Masand, T Srinivas Rao, Ananya Kundu, Prasad Rao Pedada, Y S S Srinivas, Kirti Mahajan

Study of ELMS in Presence of Stably Operating Coherent Modes
Kaushalkumar Parikh, Devendra Sharma

Modulation in MHD Instabilities in Aditya-U Plasma by Localized Radial Magnetic Field Perturbation
A. Kundu, J.Ghosh,S.Dolui, K.A.Jadeja, L.K. Pradhan, R.Kumar, R.L. Tanna, K.Singh, I. Hoque, S. Aich, H.Raj, A. Kumawat, B. Hegde, S. Banerjee, Komal, K.M. Patel, K. Galodiya, A. Patel, A. Kumar, S. Patel, N. Ramaiya, Praveenlal E V, S. Kumar, P. Kumari, A. Kumar, A. Kanik & Aditya-U Team

Integration of Passive Active Multijunction (PAM) Launcher in Aditya-U Tokamak
P. K. Sharma, P. R. Parmar, J. Kumar, K. K. Ambulkar, A. L. Thakur1 and Aditya Team

Operational Experience of 30kA 30V Power Supply with 1.4 T Electromagnet for LLMHD Experiment
Azad Makwana, Chirag Dodiya, Shrikant Verma, Upendra Prasad and Vipul Tanna

Anomalous Neutral and Impurity Dynamics in Correlation with Edge Turbulence Suppression in Aditya-U Tokamak
Harshita Raj, K. Yadav, R. Kumar, K. Singh, S. Dolui, Sk Injamul Hoque, S. Banerjee, A.

Kumawat, B. Hegde, A. Kumar, K. A. Jadeja, M.B. Chowdhuri, N. Ramaiya, S. Aich, Ankit Patel, L. Pradhan, R.L. Tanna and J. Ghosh

Up-Gradation of Controller for the Performance Enhancement of DG Sets
Chirag Bhavsar, Chandra Kishor.Gupta, G K Rajan, Prakash Parmar & Supriya A Nair

Labview Based Vacuum Control and Monitoring System for Inverse Mirror Plasma Experimental Device (IMPED)
Imran Mansuri, Jignesh Patel, Rosh Roy, Kalpesh Doshi, Bhoomi Khodiyar, Tanmay karmakar, Atish Sharma, Manisha Bhandarkar, Vishnu Patel, Hitesh Chudasma, Kirit Patel, Harish Masand, Priyadarshini Gaddam, T Srinivas Rao, Kirti Mahajan and Prabal Chattopadhyay

Development and Optimization Activity of Dip Coating Solution for Er_2O_3 Coating
Margi Jani, P A Rayjada, R Bhattacharyay, Paritosh Chaudhary

Synthesis and Characterization of Solid Tritium Breeder Material Li_2TiO_3
Rajashree Sahoo, Rajesh Kumar Singh, Paritosh Chaudhuri

Functional Analysis of CXRS Pedestal Diagnostics for FMECA & RAMI Analysis
Suraj Pillai, Gheesa Lal Vyasa, Hitesh Pandya

Study of HMC586LC4B Voltage Controlled Oscillator with Frequency Sweep Linearization for Scanned Frequency Reflectometry System
Rohit Mathur, J.J.U. Buch, Vishnu Chaudhary and SK Pathak

Effect of External Magnetic Field on Ion Density Profile in an Inertial Electrostatic Confinement Fusion Device
N.Bharali, L.Saikia, S.Kalita, S.R.Mohanty

Development of an Experimental Setup to Study the Dynamics of Laser Surface Interaction.
Renjith Kumar R, Geethika B R, Janvi Dave, Vishnu K Chaudhari, and Jinto Thomas

High Voltage Nanosecond Pulse Generator for Societal Applications
Supriya. A. Nair, Santosh C. Vora, Vaibhav Ranjan, Amol Deshpande and Anitha V. P.

Spatial Dependence of Polarized Emission from Al+ Lines in Laser Produced Aluminium Plasma
Geethika B R, Jinto Thomas, Milaan Patel, Renjith Kumar R, Hem Chandra Joshi

The Inverse Cascade in a 3D Stably Stratified 3D Yukawa Liquid Subjected Plane Couette Flow
Suruj Kalita, Rajaraman Ganesh

Effect of Self Absorption on Plasma Density Calculations from Stark Broadening in Laser Produced Plasma
Janvi Dave, Geethika B R, Jinto Thomas

Effect of Double Layer and Self Generated Micro-electric Field on the Dynamics of Naosecond Laser Generated Plasma
Jinto Thomas, Garima Arora, and Hem Chandra Joshi

Silicon Micro-Pillars Fabrication by Using Femtosecond Optical Vortex Beams
Nancy Verma, Reji Philip

Excitation of fore-Wake Structures in a Flowing Dusty Plasma
Krishan Kumar, Pintu Bandyopadhyay, Swarnima Singh and Abhijit Sen

Experimental Observation of Spherical and Cylindrical Pinned Solitons in a Flowing Dusty Plasma Medium
Prasanta Amat, Krishan Kumar, Pintu Bandyopadhyay, and A. Sen

Study of the Effect of Strong Coupling On Dusty Plasma in Hydrodynamic Regime
J. Goswami and S.S. Kausik

Plasma Stream Characteristics around a Magnetic Target in a Coaxial Plasma Accelerator
S. Singha, A. Ahmed, P. Baruah, P. P. Kalita, N. K. Neog, T. K. Borthakur

Upgradation of Pulsed Plasma Accelerator Powered By 300 KJ PPS
P. Baruah, A. Ahmed, S. Singha, P. P. Kalita, T. K. Borthakur, N. K. Neog

Laser-Cluster Interaction in an Ambient Magnetic Field with a Circularly Polarized Laser Light
Kalyani Swain, and Mrityunjay Kundu

Confinement-Driven Reconfiguration: Structural Dynamics in a Quasi Two-Dimensional Dusty Plasma Crystal
Swarnima Singh, Krishan Kumar, Pintu Bandyopadhyay, and Abhijit Sen

Self-Induced Convective Pattern formations in A Weakly Coupled Dusty Plasma
Ankit Dhaka, P. Bandyopadhyay, P.V. Subhash and A. Sen

Excitation of Cylindrical and Spherical Precursor Solitons in a Flowing Dusty Plasma
Pintu Bandyopadhyay, Krishan Kumar, Swarnima Singh and Abhijit Sen

Impact of Mobility of Electrons and Ions on the Edge Biasing in the Tokamak Boundary Plasma
Vijay Shankar, N. Bisai, Shrish Raj, and A. Sen

Impact of Rotation/Spin of Plasma Blob in Edge and Scrape off Layer of Tokamak Plasma
N Bisai

Numerical Modelling of Free-Burning Ar-Plasma and Its Interaction with the Anode
Abin Rejeesh AD, Balasubramanian C

Modeling of Unmitigated and Mitigated Disruptions with Tungsten Wall in ITER
Trivesh Kant, Amit Kumar Singh, Indranil Bandyopadhyay

Gyrokinetic Simulation of Micro-Instabilities in Aditya-U
Amit K. Singh, M Gopal Krishna, S. Choudhary, J. Mahapatra, J. Chowdhury, T. Hayward-Schneider, E. Lanti5, L. Villard and R. Ganesh

Full-Wave Simulation of 2.45GHz ECR Plasma for Starma
T. Ram, P. K. Sharma, Raju Daniel

Ubiquitous Modes in Tokamaks
Sagar Choudhary, M Gopal Krishna, Jagannath Mahapatra, Amit K. Singh, Jugal Chowdhury, T. Hayward-Schneider, E. Lanti, Rajaraman Ganesh, and Laurent Villard

Ion Temperature Gradient Modes in Tokamaks
M Gopal Krishna, Sagar Choudhury, Amit K. Singh, J. Mahapatra, J. Chowdhury, T. Hayward-Schneide, E. Lanti, R. Ganesh, L. Villard

Particle-In-Cell Simulation of Laser-Plasma Interaction: The Terahertz Light Generation
Anjana K P, Mrityunjay Kundu

Stochastic Simulations of Open-Field Plasma Particle Transport with Boundary and Bulk Sources
Nidhi Panday, Devendra Sharma

Fully Kinetic Electrostatic Particle in Cell Simulations Using Open-Source 3D Solver for Space Thruster Applications
Sneha Gupta, Tony Sandeep K, Devendra Sharma

Experimental Investigation of Complex Dynamics of a Magnetized Plasma in Presence of Plasma Bubbles
Vanshika, Ashish Rohilla, Nayab Akhtar Zaman, Mariammal Megalingam and Bornali Sarma

Optimization of Tritium Losses Due To Ion Beam Interaction for DT Neutron Production by Binary Collision Approximation Method
Varun Vijay Savadi, H.L. Swami, M. Abhangi, Ratnesh Kumar, S. Vala, Rajesh Kumar

Experimental Study of Tritium Release and Temperature Rise in a Stationary Tritium Target Holder
Ratnesh Kumar, S. Vala, H. L. Swami, M. Abhangi, Rajesh Kumar

Analysis of Tc^{99M} and P^{32} Medical Radioisotopes Production Using IPR Neutron Generator Facility
Abhishek Saxena, H.L. Swami, S. Vala, Rajesh Kumar

Detectors for Broadband Vacuum Ultraviolet Detection in ADITYA-U Tokomak
Prashant Rawat, R.L. Tanna, J. Ghosh, C.V.S. Rao and Kailash Pandey

Survey of Different Faults in Magnetic Coil Systems in ADITYA-U Tokamak
Rohit Kumar, H. Raj, L. Pradhan, S. Aich, Kaushlender Singh, Suman Dolui, Ashok Kumar, Bharat Hegde, Ankit Kumar, Shivam Gupta, M.N. Makwana, K. Shah, K.M. Patel, K.A. Jadeja, R.L Tanna, and J Ghosh

33rd Annual Conference & Exhibition on Non Destructive Evaluation & Enabling Technologies, Orchid Hotel, Pune, 7-9 December 2023

Implementation possibility of 3D Digital Image Correlation in High Heat Flux Test Facility
Mayur Mehta, Kedar Bhope, S.S. Khirwadkar

Ultrasonic Inspection Technique for He Cooled Plasma Facing Components
Kedar Bhope, MayurMehta, AlpeshPatel, ShaileshKanpara, S.S.Khirwadkar, Prakash Mokariya, NikunjPatel

2023 IEEE Microwaves, Antennas, and Propagation Conference (MAPCON), the Forum Celebration Centre, Ahmedabad, 10-12 December 2023

Rapid scanning polarizing Martin Puplett type THz Fourier transform spectrometer (FTS) for ITER ECE measurements
Ravinder Kumar, Suman Danani, J J Chaudhari, Hitesh B Pandya

Design and Characterization of High Temperature Black Body Source in MicrowaveMillimetre wave Spectrum for radiometric calibration
Varsha Siju and S.K.Pathak

Digital Video communication using salt water standing columns
A. Sarada Sree, Hitesh Chudasma, Rajanbabu and Rajesh Kumar

16th International Conference on Plasma Science and Applications (ICPSA 2023), University of Lucknow, 12-14 December 2023

Simulations of Runaway Electrons during Tokamak Startup
Ansh Patel and Santosh P. Pandya

Modelling of Synchrotron Emission Pattern Emitted by High Energetic Runaway Electrons in Tokamaks
Santosh Pandya

Diagnosing Core Ion temperature in Aditya Plasma Discharges Using Charge-Exchange Neutral Particle Analyzer (CX-NPA)
Snehlata Aggarwal, Santosh P. Pandya, and Kumar Ajay

10th International and 50th National Conference on Fluid Mechanics and Fluid Power, Indian Institute of Technology Jodhpur, 20-22 December 2023

Design, fabrication and assembly of a two-phase detection sensor array for molten lead (Pb) based heavy metal coolants
Abhishek Saraswat, Rajendraprasad Bhattacharyay, Sateesh Gedupudi

International Conference on Atomic, Molecular, Material, Nano and Optical Physics with Applications (ICAMNOP 2023), Delhi Technological University, Delhi, 20-22 December 2023

Argon Impurity Influx Estimation in ADITYA-U tokamak plasma
Aman Gautam, M.B. Chowdhuri, Nandini Yadava, Sharvil Patel, Nilam Ramaiya, R. Manchanda, Vishal Sharma, Kausalender Singh, Suman Dolui, U.C. Nagora, S.K. Pathak, K.A. Jadeja, K.M. Patel, R.L. Tanna, J. Ghosh and ADITYA-U Team
67th DAE Solid State Physics Symposium, Gandhi Institute of Technology and Management (GITAM), Visakhapatnam, 20-24 December 2023

Enhancing the Oxygen Evolution Reaction (OER) Performance by Means of Multidimensional Carbon Compounds
Amit K. Rana, Amreen A. Hussain, Suryakant B. Gupta

Tailored Antisolvent Engineering on CsPbI3 Perovskite for Black Phase Stabilization at Low Temperature
Amreen A. Hussain, Amit K. Rana, Suryakant B. Gupta

31st National Conference, Condensed Matter Days (CMDAYS 2023), Tezpur University, Assam, 22-24 January 2024

Experimental studies on decomposition of Carbon Dioxide Gas in a Glow Discharge Plasma
Deepjyoti Mahanta, Rakesh Moulick, M. Chakraborty and Ngangom Aomoa

International Conference on Computer, Electrical and Communication Engineering (ICCECE-2024), Techno India University, Kolkata, 2-3 February 2024

Time-Varying Linear Quadratic Control of Modular Multilevel Converter
Kumar Saurabh, Vivek Patel, Ashok Mankani, Aritra Chakraborty, Aditya Naugraiya, Meddi Tharun Amal S , Paul D Christain, Ujjwal Kumar Baruah

DPG Spring meeting 2024, University of Greifswald, Greifswald, Germany, 26-29 February 2024

Experimental studies of Hydrogen plasma produced in Pulsed Plasma Accelerator source
Azmirah Ahmed, Sumit Singha, Pradipta P Kalita, Pallabi Baruah, Nirod K Neog, and Tridip K

Borthakur

11th International Conference on Computing for Sustainable Global Development (INDIACom-2024), Bharati Vidyapeeth's Institute of Computer Applications and Management (BVICAM), New Delhi, 28 February -01 March 2024

Advancements in High Performance Computing Cluster Resource Utilization through a Comprehensive Monitoring Dashboard
Deepak Aggarwal, Hemant Joshi

International Conference on Frontiers in Pure and Applied Physics, University of Science & Technology, Meghalaya, 29 February 2024 - 02 March 2024

Degradation of methyl red through atmospheric pressure glow discharge plasma
Flossie B F Ch Marak, Ngangom Aomoa

3rd IEEE International Conference in Inovation in Technology (INOCON), Sai Vidya Institute of Technology, Bengaluru, 01-03 March 2024

Development of Wireless Serial Server Module for the Remote operation of various Serial Field Device in ITER-India
Deepak Mandge, Sharan Dilip E, Rajvi Parmar, Kumar Rajnish

APS March Meeting 2024, Minneapolis, Minnesota, USA, 3-8 March 2024

Aggregate Morphing of Self-Aligned Active Particles in a Confined Geometry
Anshika Chugh, Soumen De Karmakar, Rajaraman Ganesh

AWARDS and ACHIEVEMENTS

"ITER Star Award" for Three of ITER-India Colleagues for the first semester of 2023. This Pubic Recognition ITER Star Award initiated recently by ITER, is awarded every semester to ITER staff, in recognition of being exceptional, either through specific achievements, behaviors or values.

- Mr. Pratik Patel, Technical Responsible Officer of ITER-India Cryodistribution system is currently engaged in the design, manufacturing, inspection of Auxiliary Cold Boxes and the design of Thermal Shield cold valve box.
- Mr. Mahesh Jadhav, a system integrator at ITER, is currently responsible for the preparation of Engineering Work Packages for the installation of ITER Cooling Water System networks inside Tokamak Complex and auxiliary buildings.
- Mr. Mitul Patel, certified as Quality Lead Auditor and PE/NPE (Pressure equipment/ Nuclear Pressure Equipment) representative at ITER, is responsible for quality supervision/ surveillance of ITER assembly contracts & training ITER staff in welding.

Dr. Harshita Raj, received Best Poster Award for her poster entitled "Capacitor Bank-Based Power Supply Used for Shaped Plasma Operation in Aditya-U Tokamak, A Milestone in Indian Fusion Program" at DAE-BRNS National Symposium on High Voltage- Energy Storage Capacitors and Applications, DAE Convention Centre, Anushakti Nagar, Mumbai, 22-24 June 2023

[Co-authors: R. Kumar, R .L. Tanna, J. Ghosh, Bharat Arambhadiya, Vismay Raulji , Minsha Shah, K.A. Jadeja, K.M. Patel, K. Singh, S. Dolui, A. Kumar, B. Hegde, Suman Aich, ADITYA-Uand Diagnostic team]

Ms. Swarnima Singh (Research Scholar) was awarded the 2023 PPCF/EPS/IUPAP Student Poster Prize at the European Plasma Physics Conference 2023 (EPS 2023) held in Bordeaux, France during 3-7 July 2023, for her poster on "Experimental observation of a triple point for a complex (dusty) plasma".

Dr. Snehlata Aggarwal, received Best Oral Presentation Award for her presentation at National Scientific Hindi Seminar-2023, IPR, Gandhinagar, 20-21 July 2023 [Co-author: Kumar Ajay]

Dr. Nirav I. Jamnapara, received a Fellow award from ASM International, USA, bearing the citation "For sustained contributions to the field of plasma materials processing, coatings and promotion of plasma technologies for use by industry and society" on 17th October 2023

Mr. Ram Krushna Mohanta, a DDFS-Ph.D. research scholar, presented a talk on the "Effect of chamber pressure on the output properties of a DC plasma spray torch for VLPPS application" at the 12th edition of Asian Thermal Spray Conference (ATSC) held at IIT Madras from 2-4 November 2023. The talk was awarded the Best Paper Award at the ATSC 2023. [Co-authors: Devilal Kumawat, G.Ravi]

Mr. Ankit Gandhi, gave a poster presentation on "Preliminary Analysis of Supercritical Carbon Dioxide Brayton Cycle for Fusion Power Plants" at Indian Nuclear Society's International Conference: Nuclear for Clean Energy Transition (INSIC-2023), DAE Convention Centre, Mumbai, 12-15 December 2023, and have received Best Poster Award.

Ms. Swarnima Singh, gave an invited talk on "Breaking the Hexagonal Lattice Barrier: Experimental Achievement of Square Lattice Formation in 2D Dusty Plasma Crystal", at 7th Asia-Pacific Conference on Plasma Physics (AAPPS-DPP), Japan, 12-17 November 2023, and have received 2023 U30 Doctoral Scientist / Student Award.

Dr. Promod Kumar Sharma, gave a talk on "Design criteria for PAM launcher for SST1 tokamak" at the National Conference on Emerging Trends in Vacuum Electronic Devices & Applications (VEDA-2023), Godavari Institute of Engineering & Technology (GIET), Rajahmundry, 23-25 November 2023, and have received the Best Paper Award.

Dr. Amreen Ara Hussain of FCIPT, IPR, was awarded the Parvez Guzdar Young Scientist Award 2023, for her work on "Development of Hybrid Material Based Optoelectronic Devices using Plasma Technologies". The award was presented to her during a special session of the Annual Conference of the Plasma Science Society of India (Plasma-2023) held at UPES Dehradun during 4-8 December 2023. The award contained a citation and a cash prize of Rs.10,000/-. This award was instituted in memory of Dr. Parvez Guzdar by the Parvez Guzdar memorial fund.

Mr. Ashok Kumar Kumawat, gave a talk on "Calibration of a Graphite Coated Metal Foil Coating Prototype for the Metal Foil IR Bolometer in Aditya-U Tokamak" at 38th National Symposium on Plasma Science and Technology (Plasma-2023), UPES, Dehradun, 4-8 December 2023, and have received Z. H. Sholapurwala Award for Fusion Research.

Mr. Omkar Chandratre, gave a talk on "Upgradation of Indigenous Helium Refrigerator Plant to Liquefier-Operation and Capacity Test Results" at 38th National Symposium on Plasma Science and Technology (Plasma-2023), UPES, Dehradun, 4-8 December 2023, and have received Z. H. Sholapurwala Award for Fusion Research.

Mr. Raj Singh, gave a talk on "Simulation and Experimental Characterization of Coaxial Two Way Switch for RF Plasma Discharge Experiments" at 38th National Symposium on Plasma Science and Technology (Plasma-2023), UPES, Dehradun, 4-8 December 2023, and have received Z. H. Sholapurwala Award for Fusion Research.

Dr. Santosh P. Pandya, gave a talk on "Novel Techniques for the Energy Calibration of the ITER Hard X-Ray Monitor for Detection of Runaway Electrons" at 38th National Symposium on Plasma Science and Technology (Plasma-2023), UPES, Dehradun, 4-8 December 2023, and have received Z. H. Sholapurwala Award for Fusion Research.

Mr. Nikhil Mohurle, gave a talk on "Charge Collection Diagnostics with Improved SNR to Measure Plasma Charge Content, Density and Temperature in SMARTEX-C" at 38th National Symposium on Plasma Science and Technology (Plasma-2023), UPES, Dehradun, 4-8 December 2023, and have received Best Poster Award.

Ms. Manisha Jha, gave a talk on "Pattern re-configurability using plasma for beam steering application at S-band" at 2023 IEEE Microwaves, Antennas, and Propagation Conference (MAPCON), held at the Forum Celebration Centre, Ahmedabad, during 10-12 December 2023, and have received the Shrimati Ranjana Pal Memorial Award for "Best paper in antenna by a woman researcher"

Mr. Ravinder Kumar, gave a talk on "ITER-India Diagnostic Systems Ki Navintam Pragati Ka Avalokan" (in Hindi) at Akhil Bhartiya Hindi Vaigynik Sangosti-2024: Naya Bharat Harit Urja Srot, IGCAR, Kalpakkam, 10-11 January 2024, and have received the Second Prize for his presentation.

Mr. Aditya Naugraiya, gave a talk on "A Simulation Analysis of 30 kV / 5A DC Power Supply for Neutral Beam Injectors" at 3rd IEEE International Conference on Power, Control and Computing Technologies (ICPC^{2}T -2024), National Institute of Technology Raipur, Chhattisgarh, 18-20 January 2024, and have received Best Paper Award. [Co-authors: Aritra Chakraborty, Kumar Saurabh, Ashok Mankani]

Mr. Renjith Kumar R, gave a talk on "Studying the melt dynamics of a thin-film using a probe laser" at International Conference on Light Matter Interaction & Ultrafast Processes, Mahatma Gandhi University, Kerala, 1-4 March 2024, Jointly Organised by International Centre for Ultrafast Studies (ICUS), International and Inter University Center for Nanoscience and Nanotechnology (IIUCNN), and School of Pure and Applied Physics (SPAP), and have received Best Poster Presentation Award. [Co-authors: Geethika B R, Janvi Dave, Vishnu K Chaudhari, Jinto Thomas]

D.4 INVITED TALK DELIVERED BY IPR STAFF

VINAY MENON

Gave an invited talk on "A multi-physics approach to the design of a fusion reactor" at 7th National Finite Element Developers' /FEAST^{SMT} Users' Meet (NAFED07), Indian Institute of Technology, Delhi, on 30th April 2023

MUKESH RANJAN

Gave a Keynote address on "Nanostructuring for Surface Wettability and Sensing Applications" at International Conference on Advanced Materials for Emerging Technologies (ICAMET- 2023), Netaji Subash Chandra Bose University of Technology (NSUT), New Delhi, 04-06 May 2023

Gave an invited talk on "Simulating Plasma Ion Produced Nanostructures and Some Applications" at 3rd International Conference on Plasma Theory and Simulations, Jawaharlal Nehru University, New Delhi, 21-23 September 2023 [Co-authors: S. Hans, V. Pachichigar, Sooraj K.P, S. Augustine, M. Saini, Sudheer]

Gave an invited talk on "Low energy ion produced nanopatterns for SERS sensing and wettability applications" at International Conference on Condensed Matter and Device Physics,Pandit Deendayal Energy University, Gandhinagar, 27-29 September 2023

Gave an invited talk on "Low energy ion beam for nanostructuring of PTFE bulk and thin film for surface wettability and nanopatterning for sensing applications" at 7th International Conference on Nanostructuring by Ion Beams (ICNIB-2023) at UPES University, Dehradun during 2-4 November 2023

Gave an invited talk on "Hydrophobic to surperhydrophoic transitions in Ar plasma irradiated PTFE surfaces for self-cleaning application" at 13th Asian European International Conference on Plasma Surface Engineering (AEPSE-2023) at Busan, South Korea during 5-8 November 2023

Gave a talk entitled "Detection of food adulterants using plasmonic sensor" at the annual research & Innovation Conclave of the Institute of Advance Research (IAR), Gandhinagar on 6th March 2024

Gave a talk entitled "Semiconductor processing using Plasma and Ion beam" during India's Techade-Chips for Viksit Bharat: Breakthroughs in Semiconductor Research, which was hosted by HBNI, Mumbai, on 13th March 2024

Gave an online talk entitled "Harnessing Plasma for Societal Application" at the "Vigyan Yatra - 2024" jointly organized by Saurashtra University, Rajkot, Vigyan Gurjari, and GUJCOST held during 04-15 March 2024

Gave a talk entitled "Low energy beam produced nanoparticles arrays for sensing applications" at the International Conference on Sustainable Nanomaterials Integration and Organization for Energy and Environment (iSNIOE^2), Shiv Nadar University, New Delhi, 20-23 March 2024

BHARATHI MANGESH

Gave an overview talk on "Overview of Doppler Shift Spectroscopy Diagnostics Technique used in Neutral Beam Injectors - Challenges & Limitations" at 21st International Conference on Atomic Processes in Plasmas, IAEA headquarters, Vienna, 16-19 May 2023

SAPNA MISHRA

Gave an overview talk on "IN-DA Progress Report" at 43rd Meeting of the ITPA Topical Group on Diagnostics, Eindhoven DIFFER Site, Netherlands, 22-25 May 2023

SMURTI RANJAN MOHANTY

Gave an invited talk on "Inertial Electrostatic

Confinement Device: An Excellent Neutron and X-ray Generator" at DAE-BRNS National Symposium on High Voltage- Energy Storage Capacitors and Applications (HV-ESCA-2023), DAE Convention Centre, Anushakti Nagar, Mumbai, 22-24 June 2023

SUDHIR KUMAR NEMA

Gave an invited talk on "Management of Pharmaceutical & Medical Waste by Environment friendly Plasma Technologies" at Institute of Pharmacy, Nirma University, Ahmedabad under Faculty Development Programme on "Integration of Sustainable Practices in Pharmaceutical Industries and Public Health" on 13 July 2023

Gave an invited talk on "Safe disposal of different solid waste streams and energy recovery using thermal plasma technology" at IAEA Technical Meeting on Emerging Applications of Plasma Science and Technology, Vienna, Austria, 19-22 September 2023

SUDIP SENGUPTA

Gave an invited talk on "Fluid Simulation of Relativistically intense Wake Waves in a Cold Homogeneous Plasma" at 3rd Conference on Plasma Simulation (CPS), Raman Science Centre, Indian Institute of Astrophysics, Leh, Ladakh, 13-15 July 2023

JOYDEEP GHOSH

Gave an invited talk on "Why we should be persistent with Nuclear Fusion research?" at 9th PSSI - Plasma Scholars Colloquium (PSC 2023), IIT Kanpur, 20-21 July 2023

RAJIV SHARMA

Gave an invited talk entitled "Helium leak testing in Cryogenic systems" at the NDT Technical Meet organized by the Indian Society for Non-destructive Testing - ISNT Ahmedabad Chapter, on July 22, 2023

Gave a Keynote address on "Glass Fiber Reinforced Composites Insulation Material for Cryogenics and Fusion Application" at 3rd International Conference on Material Science & Engineering (ICMSE), NIT, Jalandhar, 23-25 November 2023

Gave an invited talk entitled "Thermal Insulation for 80 K Temperature Cryogenic Systems" at the 2nd International Conference on Futuristic Advancements in Materials, Manufacturing, and Thermal Sciences (ICFAMMT 2024), Institute of Infrastructure, Technology, Research, and Management (IITRAM), Ahmedabad, jointly organized by the Space Society of Mechanical Engineers (SSME), Ahmedabad, and the Department of Mechanical and Aerospace Engineering of IITRAM, Ahmedabad, 19-21 January 2024. He also chaired the Session 1 of the "Material and Composites" section of the conference.

RANJANA GANGRADEY

Gave an invited talk on "Cryopumps and it's applications Journey of Indigenous Cryopump AGASTYA, its Development & Applications, An initiative towards Atma Nirbhar Bharat" at the SSME- Ansys Seminar Series 2022-23, organized by the Space Society of Mechanical Engineers (SSME) at the Yashpal Auditorium at Space Application Centre (SAC), Ahmedabad, 27 July 2023

RAJ SINGH

Gave an invited talk on "RF and Microwaves

for Fusion Reactors" at Two Days Workshop on Emerging Research in Microwave and RF Technologies, Banasthali Vidyapith, Rajasthan, 29-30 July 2023

SURYAKANT B. GUPTA

Gave an invited talk on "Emerging Trend of Plasma Technology in Space Sector: Ground and Space Sector Applications" at National Seminar on Emerging Trends in Space Technology - Soil to Sky, Institute of Technology, Nirma University, 05 August 2023

Invited talks given at National Symposium on Gaseous Discharges (NSGD-2023), Pondicherry University, Pondicherry, 8-11 August 2023

P. BHARATHI, gave a plenary talk on "Optical Emission Spectroscopy- A Plasma Spectroscopy Diagnostics Toolbox"

DEVENDRA SHARMA, gave a talk on "Nonlinear Steepening of Quasi-Longitudinal Whistlers in resonant regime"

SUBRATO MUKHERJEE, gave a talk on "Overview of LIGO India and it commitments"

MUKESH RANJAN, gave a talk on "Plasma Material Interactions and its applications"

RAMAKRISHNA RANE, gave a talk on "Probe diagnostics-Langmuir probe"

SURYAKANT GUPTA, gave a talk on "An indigenously developed ISO test facility for ESD (arc) detection on satellite solar panels"

YASHSHRI PATIL, gave a talk on "Hollow cathode DC discharge studies using the APPEL device"

SARVESHWAR SHARMA

Gave an invited talk on "Investigating the effects of electron bounce-cyclotron resonance on plasma dynamics in capacitive discharges operated in the presence of a weak transverse magnetic field" at Princeton Plasma Physics Laboratory and Applied Materials, USA, on 14 August 2023

Gave an invited talk on "Particle-in-cell simulation of electron and ion dynamics in low pressure capacitive discharges operated by pulsed radio-frequency" at Princeton Plasma Physics Laboratory and Applied Materials, USA, on 29 August 2023

DIPAL SONI

Gave an invited talk on "Control and Protection Schema and Low power RF measurement schema used for Commissioning of ICRH RF Source" at a Workshop on Low-Level Radio Frequency (LLRF) for Particle Accelerators, Inter-University Accelerator Centre, New Delhi, 11-12th September 2023 [Co-authors: Manojkumar Patel, Sriprakash Verma, Kumar Rajnish, Gajendra Suthar, Kartik Mohan, Akhil Jha, Raghuraj Singh, Hrushikesh Dalicha, Rohit Anand, Paresh Vasava, Rajesh Trivedi]

KARISHMA QURESHI

Gave an invited talk on "A Novel Technique for measurement of thermocouple signals within High Voltage transient's environment through a special circuit" at a Workshop on Low-Level Radio Frequency (LLRF) for Particle Accelerators, Inter-University Accelerator Centre, New Delhi, 11-12th September 2023

MUKTI RANJAN JANA

Gave an invited talk on "Theory and Simulation of High Power Ion Beam" at 3rd International Conference on Plasma Theory and Simulations, Jawaharlal Nehru University, New Delhi, 21-23 September 2023

AVIK BHATTACHARYA

Gave an invited talk on "Universal circular bellows conceptual design for XRCS edge & survey" at Workshop on Vacuum extension diagnostic systems, from design to operation, ITER, Cadarache, France, 30-31 October 2023

DEEPAK MANDGE

Gave an invited talk on "IN-DA Diagnostics I&C Development Updates" at 9th CODAC Workshop on Diagnostics I&C, ITER Organization, France, 17-19 October 2023

P. K. SHARMA

Gave an invited talk on "Microwave technologies for fusion plasmas at IPR" at Electromagnetics and Microwave Engineering: Pedagogy, Research Trends and Applications Conference (EMPRA-2023), BITS, Pilani, Hyderabad Campus, 1-3 November 2023

BHOOMI SANDIP GAJJAR

Gave an overview talk on "IN-DA Progress Report" at 44th Meeting of the ITPA Topical Group on Diagnostics, ITER Organization, France, 6-9 November 2023

Invited talks given at 7th Asia-Pacific Conference on Plasma Physics (AAPPS-DPP2023), Nagoya, Japan, 12-17 November 2023

MAYUR KAKATI, gave a talk on "Studies on the retarded recrystallization of tungsten in the CPP-IPR CIMPLE- PSI device"

JAGANNATH MAHAPATRA, gave a talk on "Force-free magnetic island coalescence instability and Shear flow effects"

ANKIT DHAKA, gave a talk on "Spontaneous Fluctuations of Densities in Strongly Coupled Complex Plasmas"

RAVINDER KUMAR

Gave an invited talk on "Calibration of the ITER ECE Fourier transform spectrometer (FTS)" at Microwave Calibration Workshop, ITER Organization, France, 30th November 2023 - 1st December 2023

Gave an overview talk in Hindi on "ITER-India Diagnostic Systems Ki Navintam Pragati Ka Avalokan" at All India Hindi Scientific Seminar (AIHSS-2024), Sarabhai Auditorium, IGCAR, Kalpakkam, Tamilnadu, 10-11 January 2024

Invited talks given at 38th National Symposium on Plasma Science and Technology (Plasma-2023), UPES, Dehradun, 4-8 December 2023

SUDIP SENGUPTA, gave a talk on "Lagrangian Hydrodynamic Description of Nonlinear Plasma Waves"

RAMAKRISHNA RANE, gave a talk on "Plasma-Surface Modification for Biomedical Applications"

R. GANESH, gave a talk on "Gyrokinetic Simulation of Transport Driven by Micro-Instabilities in the Aditya-U Tokamak"

P. K. SHARMA, gave a talk on “Evolution of LH Launchers for Tokamaks at IPR”

MAHENDRAJIT SINGH, gave a talk on “Fusion Technology Development in India for ITER Deliverables and Beyond”

BRAJ KISHORE SHUKLA, gave a talk on “Development of High Power RF Systems for Tokamak Research at IPR”

N BISAI, gave a talk on “On Rotation/Spin of Plasma Blob in Edge and Scrape off Layer Regions”

S. SUNIL

Gave an invited talk on “LIGO-India: A route to innovation” at XLVI OSI Symposium (OPTIQ-2023) International Conference on Optics, Photonics and Quantum Information, Cochin University of Science and Technology (CUSAT), Kochi, 11-13 December 2023

Gave an invited talk on “LIGO-India-IPR: Possibilities in Abundance” at School of Pure and Applied Physics, Mahatma Gandhi University, Kottayam, on 14 December 2023

UPENDRA PRASAD

Gave an invited talk on “Superconducting Magnet Technology for Fusion Research-R&D update and plan” at International Conference on Recent Trends in Physics cum Alumni - Teachers Meet 2024, Dept. of Physics, Banaras Hindu University, Varanasi, Uttar Pradesh, 5-7 February 2024

ALPHONSA P. JOSEPH

Gave an invited talk on “Cold Plasma- A New Frontier in Low-temperature Plasma Applications for Healthcare” at NextGen Therapeutics: Multidisciplinary Research Approaches for Drug Development and Delivery: Bridging the Gaps: From Drug Discovery to Patient Care (NIPiCON 2024), Nirma University, Ahmedabad, 7-9 February 2024

P. VADIVEL MURUGAN

Gave an invited talk on “Thermal Plasma Technologies for Waste Management” at National Symposium EcoViSun 2024: Advancing Sustainability, Promoting Innovation, Realizing Equity (ASPIRE), Manipal University, Jaipur, 5-6 March 2024

D.5 TALKS DELIVERED BY DISTINGUISHED VISITORS AT IPR

Dr. Santosh Konuru, Vellore Institute of Technology, Tamilnadu, gave a talk on “Tungsten-Tantalum Thin Films
Performance in Fusion Tokomaks” on 17th April 2023

Dr. Hardik Vyas, Pandit Deendayal Energy University, Gandhinagar, gave a talk on “Investigation on Friction Welding of Pipes for Dissimilar Metals” on 21st April 2023

Dr. Shatadru Chaudhuri, Jadavpur University, Kolkata, gave a talk on “Dynamics of Incoherent Nonlinear Waves in Plasmas” on 27th April 2023
Dr. Akash Vyas, SVNIT, Surat, gave a talk on “Investigation on Metallurgical, Mechanical, Corrosion and Erosion Behaviour of Laser Cladded High Entropy Alloy Coatings” on 1st May 2023

Dr. Ruchi Mishra, Babasaheb Bhimrao Ambedkar University, Lucknow, gave a talk on “Study of Drug-DNA interaction using Quantum Mechanics

Tools" on 4th May 2023

Dr. Raghavendra Darji, M. S. University, Baroda, gave a talk on "Joining of thick Cu plate using Hot Wire Gas
Tungsten Arc Welding" on 26th May 2023

Dr. Chandrakanta Singh, Kalinga Institute of Industrial Technology (KIIT), Bhubaneswar, gave a talk on "Formation and Characterization of N2 Nanosecond Pulsed Laser Induced Black Silicon (LibSi) for Optoelectronics Application" on 6th June 2023

Ms. Shruti Kumari, Central Institute of Petrochemical Engineering and Technology (CIPET), Vatva, Ahmedabad,
gave a talk on "Development of Superhydrophobic PTFE Polymer Surface using Oxygen Plasma Processing" on 9th June 2023

Dr. Roshin Raj Sheeba, Physics of the Interactions of Ions and Molecules (PIIM) Laboratory, Aix -Marseille University, France, gave a talk on "Synthetic diagnostics for plasma spectroscopy of magnetic fusion devices" on 16th June 2023

Dr. Sanil Shah, Institute of Infrastructure Technology Research and Management (IITRAM), Ahmedabad, gave a talk on "Numerical study of heat transfer between impinging jets and flat moving surface" on 23rd June 2023

Mr. Rudrang B. Chauhan, M. S. University of Baroda, Vadodara, gave a talk on "Plasma oxidation of FeCrAl alloys" on 06th July 2023

Dr. Syed Enamur Rahaman, Indian Institute of Technology, Dhanbad, gave a talk on "Consideration of Physical
Effects in Analysis of Harmonically Tuned Power Amplifier to Improve Its Theory and Design" 07th July 2023

Dr. Snehanshu Maiti, Deutsches Elektronen-Synchrotron (DESY), Germany, gave a talk on "Astrophysical MHD turbulence and Cosmic ray transport" on 10th July 2023

Dr. Varun Savadi, University of Petroleum & Energy Studies, Dehradun, gave a talk on "Investigation of Thin
Layer Activation in Strategically Important Rare Earth Materials" on 14th July 2023

Dr. Ashutosh Dubey, Central University Gujarat, Gandhinagar, gave a talk on "Graphene oxide nanocomposites
for hydrogen storage application" on 18th July 2023

Dr. Vangalla Veera Babu, Indian Institute of Technology (BHU), Varanasi, gave a talk on "Design and Performance Improvement Studies of Millimeter Wave Gyro-Twystron Amplifiers" on 21st July 2023

Dr. Dinesh Rathod, University of Petroleum & Energy Studies (UPES), Dehradun, gave a talk on "Complex Plasma: Studies of Microparticle Charge, Drag Force and Associated Non-Linear Phenomena" on 27th July 2023

Dr. Vivek Patel, Motilal Nehru National Institute of Technology, Allahabad, gave a talk on "Control Techniques for Frequency Regulation in Hybrid Power Systems" on 04th August 2023

Dr. Prashant Sharma, CNRS, Orleans, France, gave a talk on "Materials in Extreme Conditions: High Temperature and Radiation Environment" on 11th August 2023

Dr. Shubham Singh Baghel, Indian Institute of Technology (IIT), Roorkee, gave a talk on "Optical diagnostics of different plasmas through collisional radiative models with the self-calculated fine structure resolved electron impact excitation cross-sections" on 18th August 2023

Dr. Sonu Kumar, Indian Institute of Technology (IIT), Delhi, gave a talk on "High Quality Electron Beam Generation through Laser Wakefield Acceleration in Bubble Regime with Its Application to Fusion" on 25th August 2023

Dr. Ajaz Ahmad Mir, Indian Institute of Technology, Jammu, gave a talk on "Nonlinear Mixing and Synchronization in Dusty Plasma" on 06th September 2023

Dr. Subhojit Bose, National Institute of Technology, Agartala, gave a talk on "Experimental Investigation of Self- Organized Criticality in Complex Space Charge Structure Formations in Glow Discharge Regime" on 15th September 2023

Dr. Yetendra Prasad Jha, Indian Institute of Technology, Delhi, gave a talk on "Sheath Characteristics of an Electron Emitting Wall in an Electropositive/Electronegative Plasma" on 25th September 2023

Dr. Rohit Sharma, Amity University, Noida, UP, gave a talk on "Two dimensional (2D) transition metal dichalcogenides (TMDC) material for the electronic applications" on 06th October 2023

Dr. Shilpa Singh, Gujarat University, Ahmedabad, gave a talk on "Structural Phase Transition, Defect Formation and Diffusion in Actinide Dioxides: A Theoretical Study" on 11th October 2023

Dr. Radhe Shyam, Malaviya National Institute of Technology, Jaipur, gave a talk on "Tuning the structural and optical properties of (K, Na)NbO3 thin films using different approaches" on 12th October 2023

Dr. Manoj Kumar Rajbhar, Indian Institute of Technology, Bhubaneswar, gave a talk on "Low Energy Ion Beam Induced Modification of Functional Nanomaterials" on 20th October 2023

Ms. Kajal Shah, Pandit Deendayal Energy University, Gandhinagar, gave a talk on "Plasma Rotation and Impurity Transport Studies in the Aditya-U Tokamak Using Spectroscopic Techniques" on 26th October, 2023

Dr. Poonam Chauan, Indian Institute of Technology, Dhanbad, gave a talk on "Development of water-repellent coatings for cellulosic and metallic surfaces" on 27th October 2023

Dr. Kaushal Purohit, SVNIT Surat, gave a talk on "Eigensolution of the various potentials and its application in different fields" on 3rd November 2023

Mr. Uday Sankar Chattopadhyay, Deputy Secretary (Retd 2020) & Faculty in ISTM,DoPT, GOI, gave a talk on "Ethics" on 3rd November 2023

Shri K N Vyas, Homi Bhabha Chair, DAE, and Former Chairman AEC & Secretary DAE, gave a talk on "Relevance of Nuclear Power and SMRs for 'Net Zero' by 2070" on 7th November 2023
Mr. Surjit Singh, Former Director, Central Vigilance Commission, gave a talk on "An Overview of CCS (conduct) Rules & CCS (CCA) Rules - Important Provisions" on 10th November 2023

Dr. Salim Hassan Siddiki, Indian Institute of Technology (ISM), Dhanbad, gave a talk on

"Multicomponent-Based Nanocomposites for Wide-Band, Thin, and Lightweight Microwave Absorbing Materials" on 10th November 2023

Prof. Arnab Rai Choudhuri, Indian Institute of Science, Bangalore, delivered "3rd. A K Sundaram Memorial Lecture" on 14th December 2023

Dr. Subhradeep Chakroborty, CSIR CEERI Pilani, gave a talk on "Recent Advances in the Research of Microstrip Antennas" on 14th December 2023

Dr. Ram Swaroop, Central University of Punjab, gave a talk on "Advancing Efficiency in Electron Cyclotron Resonance Ion Sources for Enhanced Ion Acceleration" on 15th December 2023

Dr. Pietro Barabaschi, Director General, ITER Organization, gave a talk on "Fusion & the ITER Project" on 6th February 2024

Shri Nishikant Handa, Catch Foundation, Motera, gave a talk on "General Hygiene Awareness and Waste Segregation Methods" on 23rd February 2024

Dr. Arpita Singha, Kalinga Institute of Industrial Technology, Odisha, gave a talk on "Dielectric and Ferroelectric Properties of Sodium Bismuth Titanate based Lead-free Ternary System" on 23rd February 2024

Dr. Pratik Ghosh, DA-IICT Gandhinagar, gave a talk on "Deep learning assisted microwave-plasma interaction based technique for plasma density estimation" on 01st March 2024

Dr. Anil Babu, Koneru Lakshmaiah Education Foundation (KLEF) Deemed University, Vijayawada, gave a talk on "Applications of Metasurface to Wearable Antenna: A Solution and Future Aspects" on 08th March 2024

Dr. Shalok Bharti, Nirma University, Ahmedabad, gave a talk on "Enhancing Material Properties through Friction Stir Processing: A Case Study on AA5083/ (SiC-Gr) Hybrid Surface Composite" on 15th March 2024

Dr. Zara Aftab, Jamia Millia Islamia University, New Delhi, gave a talk on "Radiation processing of metal films: structural and morphological transformations on the nanoscale" on 22nd March 2024

D.6 COLLOQUIA PRESENTED AT IPR

Dr. Bill Amatucci Robert, Naval Research Laboratory in Washington, USA, gave a talk on "Laboratory Simulation of Basic Space Plasma Phenomena" on 24th April 2023 (Colloquium #324)

Dr. Gurudas Ganguli, Naval Research Laboratory in Washington, USA, gave a talk on "NRL Current Sheet Model: Kinetic Effects of Plasma Compression" on 25th April 2023 (Colloquium #325)

Dr. Lalita Sharma, Indian Institute of Technology, Roorkee, gave a talk on "Atomic structure and collisional properties of impurity ions of fusion plasma interest" on 4th July 2023 (Colloquium #326)

Prof. Avinash Khare, Sikkim University, Gangtok, Sikkim, gave a talk on "Tunneling in dusty plasma, quantum mechanics and high jump" on 7th November 2023 (Colloquium #327)

Dr. David Reitz, Executive Director, LIGO Laboratory, California Institute of Technology, California, gave a talk on "Gravitational-wave Astrophysics with the LIGO-Virgo-KAGRA

Network: Where Have We Been, Where Are We, Where Are Going?" on 13th December 2023 (Colloquium #328)

Prof. Gurudas Ganguli, Naval Research Laboratory, Washington, gave a talk on "Orbital Debris-Generated KdV Solitons in the Ionosphere" on 16th January 2024 (Colloquium #329)

Prof. Hubertus M. Thomas, German Aerospace Center DLR, Institute of Materials Physics in Space, Germany, gave a talk on "Complex/Dusty Plasma Physics - From Laboratory to Space" on 19th January 2024 (Colloquium #330)

Prof. Swadesh Mitter Mahajan, University of Texas at Austin and ExoFusion, gave a talk on "Fusion on Earth: A Quintessentially Scientific Pursuit with an Important Commercial Goal" on 25th January 2024 (Colloquium #331)

Prof. M. Krishnamurthy, Center Director, TIFR, Hyderabad, gave a talk on "Converting liquid droplets to mini-accelerators using ultra fast lasers" on 14th February 2024 (Colloquium #332)

Prof. Kantesh Balani, Department of Materials Science and Engineering, IIT-Kanpur, gave a talk on "Advanced Materials for Fascinating Applications" on 06th March 2024 (Colloquium #333)

Prof. Sanjay Mathur, University of Cologne, Germany, gave a talk on "Catalysts of Change: Functional Materials Steering Green Hydrogen Production" on 07th March 2024 (Colloquium #334)

Dr. Animesh Kuley, Department of Physics, IISc Bangalore, gave a talk on "Global Gyrokinetic Simulation to Understand Turbulent Transport in Fusion Plasmas" on 12th March 2024 (Colloquium #335)

D.7 SCIENTIFIC MEETINGS HOSTED BY IPR

Outreach Activities @ IPR (April-June 2023)

On 4th April 2023, 56 students of B.Ed. (Science) of D. D. Choksi College of Secondary Education, Palanpur, visited the institute. On 11th April 2023, 55 students of BE(EC) and 2 faculty members of Vishwakarma Govt. Engineering College, Chandkheda, visited the institute; On 12th April 2023, 75 students of BE (IT) and 6 faculty members of L. D. College of Engineering, Ahmedabad, visited IPR; On 21th April 2023, 6 visitors from AAHWAN Group, Odisha (through GUJCOST) visited the institute; On 1st May 2023, 27 students of MBBS from Indian Institute of Public Health (IIPH), Gandhi agar, visited IPR; On 3rd May 2023, 76 students of BE(Elec) and 2 faculty members of Vishwakarma Govt. Engineering College, Chandkheda, visited IPR; On 22nd May 2023, 28 BSc Physics students and 2 faculty members of St, Xavier's College, Ahmedabad, visited the institute. On 25th May-2023, 54 students from 9-11 standard science students and 7 faculty members of the Yuva Vigyani Karyakram (YuViKa) of SAC, ISRO, Ahmedabad visited the institute; on the same day, 42 students pursuing MBA and 2 faculty members of Government MCA College, Ahmedabad, visited the institute; On 21st June 2023, 16 students of MSc Physics and Engineering of institute's Summer School Programme 2023 visited outreach lab. On 28th June 2023, 38 students of 11th & 12th Standard and 2 teachers of Delhi Public School, Gandhinagar, visited the institute.

Fire Service Week @ IPR

Fire Service Week (FSW) is observed every year to enhance general public awareness about the necessity of minimizing losses due to fire. 14th April is observed as the "Martyr's Day" to pay homage to those brave fire-fighters who sacrificed their lives while discharging their duties.

This year's theme for the FSW "**Awareness in Fire Safety for Growth of National Infrastructure (AGNI)**".

As part of the FSW, institute conducted various activities such as;

- Training-cum-demonstration on fire alarm & detection system imparted to the security personnel at the institute.
- Practical demonstration of operation of fire extinguishers was conducted for employees and security personnel at the institute, FCIPT and ITER-India office.
- Practical demonstration of operation of the fire hydrant system was conducted for employees and security personnel at IPR and ITER-India Laboratory Building.

Outreach Activities @ CPP- IPR

CPP-IPR's Outreach Cell conducted a "One Day Workshop on Plasma Physics and its Applications" on 26th April, 2023 at Pandit Deendayal Upadhyaya Adarsha Mahavidyalaya (PDUAM), Tulungia, in Bongaigaon district of Assam. PDUAM is a Model College established under the co-venture of the Central Government and the Government of Assam. The programme was attended by 22 teachers and 55 students of various departments of the college. 2 teachers and 10 students from Abhayapuri College, Abhayapuri also attended the programme. During the technical session, Dr. Rakesh Moulick gave a talk on introduction to plasma physics, followed by a talk on basics of experimental plasma physic by Dr. Ngangom Aomoa and a talk on fusion technology by Dr. B. J. Saikia. After the talks, the participants were shown a glow discharge plasma and a plasma globe, and the role and working principle of the various components of the set-ups were explained to them.

Academic Visits to CPP-IPR (May-July 2023)

On 26th May 2023, 44 students of BSc, 10 students of MSc and 5 faculty members of Royal Global University, Guwahati, Assam, visited CPP-IPR; On 07th June-2023, 14 students of BSc, 18 students of MSc and 3 faculty members of Royal Global University, Guwahati, Assam, visited CPP-IPR; On 27th June 2023, 12 students of BSc Physics and 4 faculty members of Sankardev College, Shillong, Meghalaya, visited CPP-IPR; on the same day, 27 students of BSc Physics and 3 faculty members of Mangaldai College, Upahupara, Assam, visited CPP-IPR; On 05th July 2023, 35 students (Class 8, 9 & 10) and 6 teachers of St. Francis School, Dhupdhara, Goalpara, Assam, visited CPP-IPR.

IPR @ National Technology Week - New Delhi

IPR participated in the National Technology Week celebrations that was organized at the Pragati Maidan, New Delhi during 11-14 May, 2023. The event was inaugurated by Hon. Prime Minister Shri Narendra Modi. During the inauguration, he also inaugurated several projects including the LIGO-India project. Over 15 departments under the union government participated in the technology exhibition that was organized as part of the event. IPR participated in this exhibition as part of the DAE pavilion. Over 10 working models of plasma and related technologies were on display. Nine students of BSc Physics (Hons) from Delhi University were selected and trained to explain the exhibits to the visiting public. Over a lakh people visited the exhibition.

IPR-LDCE National Technology Day 2023

IPR, in association with L D College of Engineering, Ahmedabad conducted a 2-day program to celebrate the National Technology Day at the LDCE campus at Ahmedabad during 18-19 May, 2023. This is the second year in succession that IPR and LDCE are jointly conducting this state level programme. The guests of the event were Shri Nilesh M. Desai (Director SACISRO), and Dr. Shashank Chaturvedi (Director IPR). The NTD2023 showcased several competitive events such as quiz, Skit, Elocution, Code and circuit debugging, technical models and Drafting Dynamics. Student participants from engineering colleges across Gujarat also exhibited their scientific projects at the event. IPR Outreach Division also organized an exhibition on plasma and applications. The concluding session and prize distribution was held on 19th May and Dr. P. K. Atrey, Dean R&D, IPR graced the occasion and distributed prizes to the winners of the various competitions organized as part of the event.

One-Day Workshop on Intellectual Property Rights @ CPP-IPR

One-Day Workshop on "Intellectual Property Rights" was organized by Centre of Plasma Physics-Institute for Plasma Research (CPP-IPR) under the aegis of DAE IPR Cell, Mumbai at CPP-IPR Campus, Guwahati, Assam on June 1, 2023. Dr. Saikia delivered the introductory note to the workshop. Dr. Nirav Jamnapara gave an overview of the Technology Transfer activities of IPR and specifically explained about the start-up and incubation activities being pursued by IPR. Mr. Saroj Das explained about the activities undertaken by the IPR TTIP committee. Shri. Dani P. Rajiah, Member Secretary, DAE IPR Cell, has given series of lectures on introduction to Intellectual Property (IP), various types of IP, Patenting Procedures, nonpatentable inventions, Patent Cooperation Treaty (PCT) filing, etc. At the end Shri Dani has also discussed about the DAE's Experience with Patenting.

The workshop was attended by 60 participants, of which 48 were from CPP-IPR and 12 were from various Institute / Universities like University of Science & Technology (USTM), Meghalaya; Dr. Bhubaneswar Borooah Cancer Institute (BBCI), Assam Don -Bosco University (ADBU), Assam Science Technology & Environment Council (ASTEC) and Royal Global University (RGU).

Plasma Exhibition @ Agartala

IPR outreach conducted a week long scientific outreach programme at Agartala in Tripura. The programme was organized at the ICFAI University Tripura at Agartala (Tripura), in association with the Department of Physics, ICFAI University and the Indian Association of Physics Teachers (IAPT) and on during 5-8 June, 2023. This is IPR's first outreach activity in the state of Tripura. The programme consisted of an exhibition on plasma, its applications as well as a training programme on plasma & its applications for science teachers. The event was inaugurated by Shri N. C. Sharma, Director, Higher Education, Government of Tripura. The 4-day exhibition was attended by over 600 students of schools in Agartala as well as students from the ICFAI University. As part of the event, a competition of the game "Operation Tokamak" was also organized for school and college students. Fifty students of BSc Physics from ICFAI University were trained by institute's team to explain the exhibits to visitors.

Plasma Exhibition @ Aizawl (Mizoram)

IPR outreach conducted a week-long scientific outreach programme at Aizawl in the state of

Mizoram. The programme was organized at Innovation Facility Centre of the Mizoram Science, Technology & Innovation Council (MSTIC) at Aizawl during 12-16 June, 2023. This is institute's first outreach activity in the state of Mizoram. The programme consisted of an exhibition on plasma, its applications as well as introductory talks on plasma for visiting students. The event was inaugurated by Er. H. Lalsawmliana, Chief Scientific Officer, Directorate of Science & Technology, Govt. of Mizoram. Mr. Samuel Lalmalsawma, Principal Scientific Officer, MISTIC gave the welcome speech and Mr. P. C. Lalngilneia, Senior Scientific Officer introduced the concept of plasma in vernacular language to the students. BSc Physics students from the Dept. of Physics, Pachhunga University College, Aizawl were trained by institute's team to explain the exhibits to visiting students in their local language. Officers from various Government Departments, including pollution control visited the exhibition and expressed their interest in using plasma technology in their field of work. During the 5 days, over 650 students and 25 teachers from 12 schools in the Aizawl region as well as general public and government employees visited the exhibition.

IPR @ Innovative TB Health Technologies Workshop of ICMR - Delhi

A 2-day, Innovative TB Health Technologies Workshop was organized by the Indian Council of Medical Research (ICMR) and World Health Organization (WHO) at the ICMR headquarters, New Delhi during 15-16 June, 2023. The aim of the meeting was to categorize the technologies with aim to provide support for TB Healthcare with Innovative healthcare technologies with Health technology assessment. Various innovators presented the technology and experts assessed by scoring criteria. The workshop was attended by Union Minister of State for Health and Family Welfare, Prof. S P Singh Baghel, the Union Health Secretary, Shri Rajesh Bhushan and several other dignitaries from ICMR and WHO as well as several medical innovators from across the country.
Institute was invited as one of the innovators to present technology for TB health at this workshop. Ms. Manika Sharma and Mr. Abhishek Sharma from Multidisciplinary Research Division, attended the meeting and presented AI based technology developed by institute for TB management.

Academic Visits to IPR (July-September 2023)

On 20th July 2023, 52 students of class 9, of Smt. S.J. Varmora BBA and BCA Mahila College, Wadhwan, visited the instute; on 31st July 2023, 21 students of classes 11-12 Science, of Swaminarayan Dham International, School, Gandhinagar, visited the instute;

On 1st August 2023, 70 students of class 9 of Pragati English Medium High School, Ahmedabad, visited IPR; on 2nd August 2023, 38 students of B.Tech. (Electrical) from Silver Oak University, Ahmedabad, visited IPR; on 3rd August 2023, 42 students of classes 10-12 of Saint Kabir School, Ahmedabad, visited IPR; on 4th August 2023, 62 students of Diploma in Electrical from D. N. Polytechnic, Ahmedabad, visited the institute; on 7th August 2023, 66 students of classes 11-12 Science from Hiramani Higher Secondary School, Ahmedabad, visited the instute; on 14th August 2023, 45 students of class 10 of Pragati English Medium High School, Ahmedabad and 4 faculty members from Indian Institute of Science Education and Research, Pune, visited the instute; on 16th August 2023, 90 students of class 12 science of Delhi Public School, Bopal, visited the instute; on 17th August 2023, 44 students of class 11-12 science of Pragati English Medium High School,

Ahmedabad, visited IPR; on 18th August 2023, 56 students of B. Tech (IT), Atmiya University, Rajkot, and 32 students of 10-12 standard from Amrita Vidyalaya, Ahmedabad, visited the instute; on 21st August 2023, 50 students from 8-11 standard from Young Indians (YI), Ahmedabad, visited the institute; on 23rd August 2023, 85 students of B.Tech (IT) VI semester from LDRP Institute of Technology and Research, Gandhinagar, visited IPR; on 24th August 2023, 82 students of B.Tech (IT) V semester from LDRP Institute of Technology and Research, Gandhinagar, visited the institute; on 25th August 2023, 56 students of class 8-11 from Sardar Patel and Swami Vivekananda High School, Ahmedabad, visited the instute;

On 18th September 2023, 130 students of B.Tech (Electrical) from Nirma University, Ahmedabad, visited IPR; on 21st September 2023, 123 students of 11th class (science) from Panchteerth Vidyalaya, Ahmedabad, visited IPR; on 23rd September 2023, 43 students of BSc. & MSc. (Physics, Math) from Parul Institute of Applied Sciences, Waghodiya, Vadodara visited IPR.

Plasma Exhibition @ Chennai

IPR Outreach conducted a week-long scientific outreach programme at the Periyar Science & Technology Centre, Chennai in collaboration with IGCAR Kalpakkam during 3-7 July, 2023. This is IPR's first outreach activity in the state of Tamil Nadu. The programme consisted of an exhibition on plasma, its applications as well as introductory talks on plasma for visiting students.
The event was inaugurated by Prof. Nilesh J. Vasa, Dean, IIT Madras and Dr. V Subramanian Head RESD, SQRMG (IGCAR) was the Guest of Honour. The event was coordinated by Shri. I. K. Lenin Tamilkovan, Executive Director, Tamilnadu Science & Technology Centre, Chennai.

For this exhibition, 72 UG and PG (Physics/ Mathematics) students volunteers from various colleges in Chennai such as Dwaraka Doss Goverdhan Doss Vaishnav College, Ethiraj College for Women, Loyola College, University of Madras and the Madras Christian College were trained by IPR team to explain the exhibits to visiting students in their local language. Over 3500 students and general public visited the exhibition at Chennai.

Plasma Exhibition @ Thaltej (Ahmedabad)

Institute for Plasma Research (IPR), Gandhinagar (Gujarat), in association with the Vishwabharati School, Thaltej, Ahmedabad, organized an exhibition on Plasma, the fourth state of matter during 8-10 July, 2023. This program is part of IPR's rural scientific outreach activity in the state of Gujarat. The programme consisted of an exhibition on plasma, its applications as well as introductory talks on plasma for visiting students. For this exhibition, science students from class 9-11 as well as students of B.Ed. course of Viswabharati were trained by IPR team to explain the exhibits to visiting students in their local language. Over 800 students and general public visited the exhibition at Vishwabharati School.

Plasma Exhibition @ Coimbatore

IPR Outreach conducted a week-long scientific outreach programme at the Department of Physics, Bharathiar University, Coimbatore during 10-14 July, 2023. This is IPR's second outreach activity in the state of Tamilnadu. The programme consisted of an exhibition on plasma, its applications as well as introductory talks on plasma for visiting students.
The event was inaugurated by Prof. V. Selvarajan, eminent plasma physicist and former HoD of Physics, Bharathiar University. The function was presided over by Dr. K Srinivasan (HoD Physics)

and Prof. F. X. Lovelina Little Flower (Syndicate Member). The event was coordinated by Prof. G. Shanmugavelayutham of the Dept of Physics, Bharathiar University.

For this exhibition, 67 UG, PG and Research Scholars of the Department of Physics, Bharathiar University were trained by IPR team to explain the exhibits to visiting students in their local language. The concluding function was organized on 14th July, 2023 and was attended by Prof. K. Murugavel (Registrar, BU) and Prof. K Ramachandran (UGC Professor, Dept of Physics). Over 2300 students and general public visited the exhibition at Bharathiar University.

Plasma Exhibition @ Palanpur (Gujarat)

IPR Outreach conducted a week-long scientific outreach programme (Rural) at the main campus of the Vidyamandir Trust, Palanpur, Gujarat during 25-27 July, 2023. This program is part of IPR's rural scientific outreach activity in the state of Gujarat. The programme consisted of an exhibition on plasma, its applications as well as introductory talks on plasma for visiting students. The event was inaugurated by Ms. Manjula Sachin, Assistant Director (English medium), Vidyamandir Trust. For this exhibition, 83 UG students from various schools under the Vidyamandir Trust were trained by IPR team to explain the exhibits to visiting students in their local language. Eight science teachers from Vidyamandir Trust were also imparted training on plasma, its applications and nuclear fusion. Over 5000 students and general public visited the exhibition at Vidyamandir Trust.

Observation of Anti-Ragging Day/Week-2023 at IPR

To bring the awareness on prevention of ragging among the students and staff, IPR had observed Anti-Ragging Day on 12th August 2023 followed by Anti-Ragging Week during 12th August to 18th August 2023. The Dean Academics of Institute for Plasma Research had administered the oath against ragging practice on the Anti-ragging day. In the week that followed, competitions were conducted on slogan and essay writing, logo and poster making. The anti-ragging week was concluded with a brief speech by Dean, Administration of IPR followed by a special lecture by Dr. S. Shalini from Karnavati University on the Psychology behind ragging and its prevention. The winners and runners-up of various competitions were awarded prizes. Dean- R&D, IPR gave a short summary and presented the vote of thanks

Plasma Scholars Colloquium (PSC-2023) @ IIT Kanpur

The 9th PSSI - Plasma Scholars Colloquium (PSC-2023) organized by IIT Kanpur and PSSI during 20-21 August, 2023. The colloquium had a total of 64 participants, including students and postdocs. Among them, 14 students delivered oral talks and 9 flash talks along with 50 poster presentations covering topics from space plasmas, fusion plasmas, basic laboratory plasma experiments and simulations, and plasma applications. The concept of flash talk was a new addition this year, where participants shared their research in a brief five-minute talk, followed by a detailed in the poster presentation. Additionally, seven experts in relevant fields delivered Invited Expert lectures. In addition to this, an invited General Physics Lecture titled "Patterns Arise from Conflicts" was delivered by Prof. Jayanta K. Bhattacharjee, and an Invited Public Lecture titled "Indian Knowledge System and Modern Science and Technology" by Prof. Manoj K. Harbola. At the conclusion of the second day, awards were given for exceptional presentations, which comprised of four best oral

and three best poster prizes.

Activities of CPP-IPR Outreach Cell (August-September 2023)

CPP-IPR's Outreach Cell conducted a "One Day Seminar cum Workshop on Plasma Physics" on 17th August, 2023 at Pragjyotish College, Guwahati. The programme was attended by 5 teachers and 72 students of the college, including the principal of the college, Dr. Manoj Kumar Mahanta, an alumnus of CPP-IPR. 6 students from Pandu College, Guwahati also attended the programme. During the technical session, Dr. Rakesh Moulick gave a talk on introduction to plasma physics, followed by a talk on basics of experimental plasma physic by Dr. Ngangom Aomoa. After the talks, the participants were shown a glow discharge plasma, arc plasma (Jacob's ladder) and a plasma globe, and working principle of the setups and their various components were explained to them.

CPP-IPR's Outreach Cell conducted a "One Day Workshop on Basic Plasma Physics" on 1st September 2023 at Assam Don Bosco University (ADBU), Sonapur, Assam. The workshop was attended by 39 participants from 7 institutions and 6 faculty members.

Plasma Exhibition @ Puttur (Karnataka)

Institute for Plasma Research (IPR), Gandhinagar (Gujarat), in association with the Vivekananda College of Arts, Science & Commerce, Puttur, Karnataka, organized an exhibition on Plasma, the fourth state of matter during 30th August to 1st September 2023. This program is part of IPR's rural scientific outreach activity in the state of Karnataka. The programme consisted of an exhibition on plasma, its applications, introductory talks on plasma for visiting students as well as a training program for science teachers on plasma and its applications and nuclear fusion. The event was inaugurated by Prof. C. H. Ishwara Chandra, Dean, GMRT Observatory, (TIFR), Pune. Dr. K. P. Bhat, President Vivekananda Vidyavardhaka Sangha, Puttur, presided over the function. For this exhibition, 50 science students from BSc Physics and engineering of Vivekananda College were trained by IPR team to explain the exhibits to visiting students in their local language. Over 4000 students and general public visited the exhibition at Vivekananda College.

Visit of BRNS Team to IPR

Shri M. K. Sapra, OS & Scientific Secretary, BRNS, along with a team of officers, visited IPR and FCIPT on 6 September 2023. Shri Sapra delivered a talk on "Role & Functioning of BRNS" at IPR. The talk was attended by many officers of the institute, who are/could be potential PCs or reviewers of ongoing / future BRNS projects. The talk was followed by fruitful interactions between attendees and BRNS team. Later, the BRNS team visited various labs in IPR and FCIPT.

Plasma Exhibition @ Kozhikode (Kerala)

Institute for Plasma Research (IPR), Gandhinagar, in association with the National Institute of Technology (NIT) Calicut (Kerala), the District Institute of Education & Training (DIET), Kozhikode and the EduMission Kozhikode, organized "The 4th State : Plasma Exhibition" during 4-8 September, 2023 at NIT Calicut. This program, which is part of IPR's scientific outreach activity in the state of Kerala was organized as "CURICON-Plasma Exhibition and Innovation Fest" event for school and college students of the district of Kozhikode, Kerala. The programme consisted of an exhibition on plasma, its applications, and introductory talks on plasma

for visiting students as well as a training program for science teachers on plasma and its applications and nuclear fusion.

The event was inaugurated by Prof. M. K. Jayaraj, Vice-Chancellor, Calicut University. For this exhibition, engineering and physics students from NIT-C as well as science teachers from several schools in Kozhikode district were trained by IPR team to explain the exhibits to visiting students in their local language. Training programme for 25 science teachers from schools in Kozhikode district was also conducted during the event. Over 12,000 students and general public visited the exhibition at NIT-Calicut.

Plasma Exhibition @ Thiruvananthapuram (Kerala)

Institute for Plasma Research (IPR), Gandhinagar (Gujarat), in association with the Rajadhani College of Engineering & Technology (RIET), Attingal (Thiruvanathapuram District), organized an exhibition on Plasma, the fourth state of matter during 11-15 September, 2023. This program is part of IPR's rural scientific outreach activity in the state of Kerala. The programme consisted of an exhibition on plasma, its applications as well as introductory talks on plasma for visiting students. The event was inaugurated by Dr. M. S. Rajashree, Director of Technical Education, Government of Kerala. For this exhibition, 56 engineering students from RIET were trained by IPR team to explain the exhibits to visiting students in their local language. A quiz competition for school students was also organized by IPR during the event. A training program on plasma, its applications and nuclear fusion was also organized for 38 faculty members of RIET. Over 3000 students and general public visited the exhibition at Rajadhani College of Engineering & Technology. The event was coordinated by Prof. Parvathy Pratap of RIET.

Swachhata Hi Seva Campaign-2023

During the "Swachhatha Hi Sewa" campaign organized during 18 September to 2 October 2023 at IPR, FCIPT, CPP-IPR and ITER India, the following events were organized;

- Banner display at IPR, FCIPT, ITER-India and Centre of Plasma Physics, Guwahati, Assam
- Swachhata Pledge was taken by staff at IPR, FCIPT, ITER-India and CPP-IPR
- Special cleaning and garbage collection drives undertaken at IPR, FCIPT, ITER-India and CPP-IPR campuses
- Slogan writing competition on Swachhata organized at IPR and CPP-IPR
- Talk on Swachhata awareness by Shri Devendra Parekh from Environmental Sanitation Institute, Sughad.
- Shramdaan: Plastic garbage collection drive was conducted on 1 Oct 2023 at IPR in which about 60 participants including staff members, volunteers and Swachhata Sevaks took part. Terrace of IPR premises was also cleaned during the drive. CPP-IPR also conducted the cleanliness drive at nearby Tepesia village as part of Swachhata Abhiyan.
- Posters on sanitation awareness were displayed at IPR premises to spread Swachhata messages.
- The committee invited students from local schools to take part in a Swachhata walk and a quiz competition on 2nd October with a focus on Swachhata practices. The students also participated in the Swachhata pledge ceremony and Swachhata walk from IPR to Kanoria hospital carrying Swachhata banners and voicing Swachhata awareness slogans.
- Slogan writing competition and an oral presentation competition was organized by CPP-IPR.
- Staff members and volunteers participated in

the tree plantation event which was held on 2nd October 2023 at IPR campus

The campaign's final session featured an interactive presentation on "Man Ki Swachhata" by senior members of "Art of Living" foundation Shri Vivek Sharmaji and Ameya Munjeji. IPR employees and students participated in the session. The campaign activities were briefly summarized and the winners of the slogan contest were presented with prizes. Chairman of the Swachhata Hi Seva Campaign Committee 2023, Mr. Dilip Raval, presented the vote of thanks. Dr. Mukherjee Dean (Administration), and CAO Shri Niranjan Vaishnav also addressed the audience and shared their views on the campaign.

Plasma Exhibition @ Shahpur (Himachal Pradesh)

Institute for Plasma Research (IPR), Gandhinagar (Gujarat), in association with the Central University of Himachal Pradesh (CUHP), Shahpur Campus (Kangra District), Himachal Pradesh, organized an exhibition on Plasma, the fourth state of matter during 09-13 October, 2023. This program is part of IPR's rural scientific outreach activity in various states of India. This is the first outreach activity of IPR to be held in the state of Himachal Pradesh. The programme consisted of an exhibition on plasma, its applications as well as introductory talks on plasma for visiting students. The event was inaugurated by Prof. Pardeep Kumar, Dean-Academics, CUHP. For this exhibition, over 50 students of BSc and MSc Physics from CUHP were trained by IPR team to explain the exhibits to visiting students in their local language. A fun filled competition for the volunteers in assembling the TokoToy model was also organized as part of the event.

Academic Visits to IPR (October 2023)

On 4th October 2023, 19 students of B. Tech (Electrical) from Vishwakarma Govt. Engineering College, Ahmedabad, visited IPR; on 9th October 2023, 67 students of classes 10-12 (Science) from Anand Niketan School, Sughad, Gandhinagar, visited IPR; on 10th October 2023, 26 students of classes 6-10 from Air Force Family Welfare Association, Gandhinagar, visited IPR; on 11th October 2023, 12 students of BSc Physics from Ahmedabad University, Ahmedabad visited IPR; on 13th October 2023, 56 students of Diploma in engineering from Government Polytechnic, Palanpur visited IPR; on 16th October 2023, 17 students of class 12 (Science) from Expert Group of Institutes, Mangalore visited IPR; on 17th October 2023, 68 students of class 11-12 (Science) from Maharaja Agrasen Vidyalaya, Ahmedabad visited IPR; on 25th October 2023, 30 students of science communication from Ahmedabad University, Ahmedabad visited IPR

Outreach Activities of CPP-IPR (October 2023)

On 12th October 2023, 19 students of B.Sc. Physics and 4 teachers from Synod College, Shillong, Meghalaya visited CPP-IPR

Plasma Exhibition @ Mandi (Himachal Pradesh)

Institute for Plasma Research (IPR), Gandhinagar (Gujarat), in association with the Vallabh Government College, Mandi (H.P.), organized an exhibition on Plasma, the fourth state of matter during 16-20 October, 2023. This program is part of IPR's rural scientific outreach activity in various states of India. This is the second outreach activity of IPR to be held in the state of Himachal Pradesh.

The programme consisted of an exhibition on plasma, its applications as well as introductory talks on plasma for visiting students as well as training program for teachers of VGC. The event was inaugurated by Prof. Lalit Malhotra, former Deputy Director, IIT Delhi. For this exhibition, 48 students of BSc Physics and Chemistry from VGC as well as S. P. University, Mandi were trained by IPR team to explain the exhibits to visiting students in their local language. A training program for teachers on plasma, its applications and fusion was also arranged as part of this event. A fun filled competition for the student volunteers in assembling the TokoToy model was also organized as part of the event. Over 2500 students and general public visited the exhibition at the Vallabh Government College. The event was coordinated by Dr. Vikas Thankur and Dr. Jitender Kumar of VGC.

Vigilance Awareness Week -2023

IPR observed the "Vigilance Awareness Week -2023" during 30 October - 5 November, 2023. As part of the event, a series of talks related to vigilance from senior personnel from IPR Administration, Accounts, Purchase and Stores were arranged. Also, talks/seminars by external subject experts on Cyber Security, CCS rules, functions of CVC, CVO and IO/PO etc were also arranged for the benefit of IPR staff members. Various competitive events were also organized at IPR to bring about awareness regarding Vigilance. A Nukkad Natak was also enacted by IPR staff on the last day of the week, which was well received by the audience.

Plasma Exhibition @ Bhimtal (Uttrakhand)

Institute for Plasma Research (IPR), Gandhinagar (Gujarat), in association with the Birla Institute of Applied Sciences (BIAS), Bhimtal, Uttrakhand organized an exhibition on Plasma, the fourth state of matter during 27 November to 1 December, 2023. This program is part of IPR's rural scientific outreach activity in various states of India. This is the first outreach activity of IPR to be held in the state of Uttrakhand. The programme consisted of an exhibition on plasma, its applications, training programme for student volunteers, introductory talks on plasma for visiting students as well as competition on tokamak toy assembly for the students of BIAS. The event was inaugurated by Dr. B.K. Singh, Director of Birla Institute of Applied Sciences (BIAS). For this exhibition, 55 students of BTech electronics and computer science from BIAS were trained by IPR team to explain the exhibits to visiting students. A fun filled competition for the student volunteers in assembling the TokoToy model was also organized as part of the event. Over 1000 students from schools in and around Bhimtal and Nainital as well as students from BIAS and general public visited the exhibition at BIAS.

Academic Visits to IPR (November, 2023)

On 1st November 2023, 62 students of 11 & 12th Std (Science) from Countryside School, Surat, visited IPR; on 2nd November 2023, 126 students of BE (CE) from SN Patel Institute, Bardoli, visited IPR; on 7th November 2023, 29 students of 11 & 12th Std (Science) from SGVP International School, Ahmedabad, visited IPR; on 7th November 2023, 85 students of 9-11th Std from Divyapath School, Ahmedabad, visited IPR; on 22nd November 2023, 88 students of 11 & 12th Std (Science) from Anand Vidyavihar, Vadodara, visited IPR.

Buyer-Vendor Meet @ IPR

A "Buyer-Vendor meet" was jointly organized by Indore Regional Purchase & Stores Unit (IRPSU) & Institute for Plasma Research (IPR) Gandhinagar on December 04, 2023 at IPR. It was organized with an intention to educate the vendor community

to address various issues being faces by Vendors and sellers and also to get their feedback on the new GeM Portal & CPP Portal. About 43 Bidders/ vendors participated from across the country in person and 34 participated in online mode.

Shri Devendra Modi, Head-PMMD, IPR welcomed all the vendors who participated in this meeting in person and online. The meet was inaugurated by Dr. Shashank Chaturvedi, Director, IPR, Dr. Padmakumar G, Director, DPS, Shri Avinash Puntambekar, Regional Director, IRPSU, Prof. S. Mukharjee, Dean, Administration IPR, Dr. Paritosh Chaudhuri, Dean (R&D), IPR, Shri Amit Kumar Srivastava, Chairperson, Senior Purchase Committee, IPR and Dr. V. Prahlad, Chairperson, Stores Committee, IPR.

Nobel Prize Day @ Gujarat Science City

Gujarat Council of Science City celebrated the Nobel Prize Day on December 10, 2023. Dr. Paritosh Chaudhuri and Ms. Chhaya Chavda were invited to participate in this event and they addressed the gathering of high school students on the topics of Noble Prize as well as various outreach activities of IPR.

Academic Visits to IPR (December 2023)

On 13th December 2023, 30 students of class 11-12 from Gajera Global School, Surat, visited IPR; on 14th December 2023, 68 student of B.Tech from National Forensic Science University, Gandhinagar, visited IPR; on 15th December 2023, 77 students of class 9-10 from Sughad Primary School, Sughad, Gandhinagar, visited IPR; on 18th December 2023, 44 students of class 6-8 from Koteshwar Prathmik Shala, Koteshwar, Gandhinagar, visited IPR; on 19th December 2023, 71 students of class 6-8 from Motera Kanya Primary School, Motera, Ahmedabad, visited IPR; on 19th December 2023, 48 students of B.Tech from Geetanjali Institute of Technical Studies, Dabok, Rajasthan, visited IPR; on 20th December 2023, 40 students of class 9-11 from Sheth N M Patel High School, Rancharda, Gandhinagar, visited IPR; on 20th December 2023, 61 students of class 6-8 from Hudko Primary School, Bhat, Gandhinagar, visited IPR; on 21st December 2023, 75 students of class 9-10 from Sarvoday Vidya Mandir (School), Bhat, Gandhinagar, visited IPR; on 21st December 2023, 75 students of class 7-8 from Bhat Primary School, Bhat, Gandhinagar, visited IPR.

LIGO-India Update

Prof. David H. Reitze, Director, LIGO Laboratory and Dr. Brian O'Reilly, Lead Scientist, LIGO Laboratory visited IPR during 13-14, December 2023. During their visit, they visited the LIGO-Lab in the New R&D building to see newly installed LI-VISTA (LIGO-India – Vacuum Integrated System Test Assembly) facility where 20 m vacuum vessel and 80K Cryopump installation and testing work is in progress. This visit could demonstrate LIGO-USA team Indian industries capabilities to take up fabrication of LIGO-India vacuum system for main project. During discussions, the LIGO division updated them on other ongoing activities of LIGO-India project in which LIGO-Division, IPR is involved.

Dr. Brian O'Reilly also visited the LIGO-India Project site at Hingoli, Maharashtra along with Mr. Hitesh Gulati, Mr. Vijay Bedakihale and other members from DCSEM and IUCAA to see and assess the LIGO-India site work in progress. Prof. David H. Reitze gave a colloquium on "Gravitational-wave Astrophysics with the LIGO-Virgo-KAGRA Network: Where Have We Been, Where Are We, Where Are Going?" on 13th December, 2023 at IPR.

3rd A. K. Sundaram Memorial Lecture

The 3rd A. K. Sundaram Memorial Lecture was delivered by Professor Arnab Rai Choudhuri, Indian Institute of Science, Bengaluru, at IPR on 14th December, 2023. In his lecture, Prof Choudhuri talked about the 11-year sunspot cycle and the dynamo process in the sun-based prediction of the solar cycle which was carried out by Prof. Choudhuri and his group. Prof. A. K. Sundaram was a past, distinguished faculty member and Dean of IPR.

Solar Observation Event @ S.P. University, Anand

As a part of IPR's outreach activities, Outreach Division conducted its first solar observation event for students was organized at the Department of Physics, Sardar Patel University at Vallabh Vidyanagar, Anand (Gujarat) on 28th December 2023. This event was organized by the Astronomy Club of the Department of Physics, S.P. University and coordinated by Prof. B.Y. Thakore. Students of BSc and MSc Physics of S. P. University as well as faculty members participated in this event. IPR's solar telescope with high resolution H-Alpha filter was used for this event. Students not only viewed the details of the surface of the sun with the telescope, but also were given information about the telescope, solar imaging techniques, H-alpha filters etc, during the course of the event.

Academic Visits to CPP-IPR (January-February 2024)

On 4th January 2024, 24 students and 4 teachers from Nazirakhat L. Primary School, Kamrup, Assam, visited CPP-IPR; on 5th January 2024, 6 B. Sc. students and 4 teachers from Mairang Presbyterian Science College, Mairang, Meghalaya, visited CPP-IPR; on 23rd February 2024, 49 students of BSc Physics and 5 faculty from St. Joseph's College, Jakhama, Nagaland, visited CPP-IPR.

Solar Observation Event @ CVM University, Anand

As part of the 70 Year Platinum Jubilee celebration of DAE, IPR organized a solar observation event at the "Gyanostav 2024". This event was organized by the Charutar Vidya Mandal University, Vallabh Vidyanagar, Anand (Gujarat) on 4th January, 2024 at Vallabh Vidyanagar, Anand (Gujarat). IPR's solar telescope with high resolution H-Alpha filter was used for this event. Students not only viewed the details of the surface of the sun with the telescope, but also were given information about the telescope, solar imaging techniques, H-alpha filters etc, during the course of the event. Over 1000 students and general public got an opportunity to view the surface of the sun and observe sunspots, filaments, phages and prominences. IPR staff explained these phenomenon as well as the working of the solar telescope with emphasis on how to safely observe the sun to the visitors. The event was coordinated by Dr. Foram Joshi of CVM University.

9th India International Science Festival (IISF-2023) Related Activities @IPR

Ministry of Science & Technology, the Ministry of Earth Sciences, the Department of Space, and the Department of Atomic Energy, in association with Vijnana Bharati (VIBHA), is organizing the 9th India International Science Festival (IISF-2023) during 17-20 January 2024 at Faridabad, Haryana. As per the government directive, in connection with this, special outreach activities were organized at IPR main campus during 13-22 December, 2023. During this period, students

of several schools visited IPR. During their visit, the students were given an introduction to plasma and its applications, given live demonstrations of plasma with over 25 exhibits and were also taken on a tour of the SST-1 tokamak at IPR. During this period, over 500 students and teachers of 10 schools and two colleges visited IPR.

DAE Platinum Jubilee National Science Day 2024

The National Science Day, conducted under the aegis of the Platinum Jubilee Celebrations of the Department of Atomic Energy (DAE) was conducted as an offline event at IPR main campus after a gap of three years. Over 350 students and 80 teachers from 44 schools participated in this 2-day event held on 10-11 February, 2024. The program was inaugurated by Dr. Paritosh Chaudhuri, Dean R&D and Mr. Niranjan Vaishnaw, CAO, IPR. Seven competitive events were conducted in which 21 prizes were awarded. Apart from the competitive events, this event also had open house visits to various labs of IPR as well as a solar observation event using the high resolution solar telescope of IPR outreach. Around 45 students and 5 teachers participated in the science model competition. St Xavier's High School, Gandhinagar was awarded the IPR NSD Rolling trophy for scoring the maximum points in the competitive events. Over 3000 people visited IPR during these days.

Academic Visits to IPR (February-March 2024)

On 1st February 2024, 25 students of BSc Physics and 2 faculty from Bahauddin Science College, Junagadh visited IPR; on 7th February 2024, 25 students of MSc/PhD Physics and 1 faculty from Marwadi University, Rajkot, visited IPR; on 15th February 2024, 26 students of BSc/MSc Physics and 3 faculty from Christ College, Rajkot, visited IPR; on 19th February 2024, 25 students of diploma in electrical engineering and 2 faculty from K. D. Polytechnic, Patan, visited IPR; on 5th March 2024, 34 students of BSc/MSc Applied Physics and 3 faculty from Dept. of Nano Science, Saurashtra University, Rajkot, visited IPR; on 6th March 2024, 86 students of BE(IT) and 4 faculty from LDRP Institute of Tech. & Research, Gandhinagar, visited IPR

Outreach Activities of CPP-IPR

CPP-IPR's Outreach Cell conducted a "One Day Seminar cum Workshop on Plasma Physics" on 16th February, 2024 at Arya Vidyapeeth College, Guwahati. The programme was attended by 6 teachers and 45 students of Physics Department of the college. During the technical session, Dr. Rakesh Moulick gave a talk on introduction to plasma physics, followed by a talk on basics of experimental plasma physic by Dr. Ngangom Aomoa. After the talks, the participants were shown a glow discharge plasma, arc plasma (Jacob's ladder) and a plasma globe, and working principle and role of various components of the set-ups were explained to them

Plasma Exhibition @ Science Week 2024 - Bhavnagar

IPR Outreach participated in the Science Week-2024 held as part of the 100th birth anniversary of Shri Balvantray Parekh during 22-24 February, 2024. During this event organized at the Shri Balvant Parekh Science City, Bhavnagar, IPR exhibited several interactive models of plasma and its applications. Over 2500 students and general public visited the exhibition.

Swachhata Pakhwada - 2024

Swachhata Pakhwada was held during 16-29 February 2024 at Institute for Plasma Research, Bhat Campus, FCIPT-IPR, ITER-India and Centre of Plasma Physics, Guwahati campuses. Over the fortnight, several programs focused on cleanliness were carried out at these campuses. Competitive events like quiz, slogan writing were conducted for staff members. In addition to cleaning of the campuses, events like, popular talks, tree planting, Swachhata walk with plogging etc were conducted. A Swachhata Pledge was administered to staff members at all the campuses.

On and off-campus cleanup efforts focused on collecting waste, particularly single-use plastic (SUP), polystyrene (thermocol) etc. The participants were also made aware of the management of single-use plastics and subsequently reduce their use with an emphasis on substituting sustainable alternatives.

Plasma Exhibition @ Science City Ahmedabad - Science Carnival 2024

IPR participated in the annual Science Carnival hosted by the Gujarat Science City as part of the Science Day celebrations of the Government of Gujarat. The event was organized during 28-February to 3-March, 2024 at the Gujarat Science City, Ahmedabad. The exhibition was inaugurated by Ms. Mona K. Khandhar, IAS, Principal Secretary, Department of Science & Technology, Government of Gujarat, who also visited the IPR exhibition. IPR outreach exhibited 25 models of plasma, its applications and nuclear fusion at this event. 25 Student scientific volunteers from St Xavier's College, Ahmedabad were trained to explain the models to visitors. Over 5000 people visited the exhibition.

PTPS2024 @ IPR

A one-day seminar on "Plasma Technologies for Purification and Sterilization" (PTPS2024) was organized at IPR on 1st March 2024. The seminar was graced by the presence of the chief guest Dr. Sunil Shukla, Director General EDII (Entrepreneurship Development Institute of India). The participants in this seminar were belonging to industries, medical institutions, research organizations, academicians and also students. A demonstration of plasma technologies developed by IPR was also organized for the participants of this seminar during FCIPT tour. In the end, a panel discussion was held with the brainstorming discussion on the bridging of gap for acceptance of promising plasma technologies by the medical institutions within India through mandatory certifications and approach for the same. The seminar was also in line with the "Make in India" program of Government of India in which the role of researchers in building indigenous technologies is paramount.

National Science Day @ CPP-IPR

Outreach Cell of CPP-IPR, in active co-operation of the faculty members, staff and research scholars, celebrated the National Science Day on 1st March, 2024 with day-long programmes. The theme for this year's events was "Indigenous Technologies for Viksit Bharat." D. Jayanta Kumar Sarma, a distinguished environmentalist of national repute and a renowned consultant of Natural Resource Management and Livelihood, delivered a popular talk on this year's theme. Several competitions (essay writing and drawing on the theme, science quiz, extempore speech etc.) were organized among school students on invitation basis as well as on the spot basis. A large number of students and teachers from various schools from Sonapur area visited the campus on the day and participated in various events. In the concluding session in the afternoon, prizes were distributed by Prof. Anurup Gohain

Barua, Department of Physics, Gauhati University.

53rd National Safety Week – 2024 @ IPR

The 53rd National Safety Week was celebrated at IPR from 4-10 March 2024. This year's theme was "Focus on Safety Leadership for Environmental Social and Governance (E.S.G.) Excellence". IPR organized various competitions to create safety awareness amongst its employees. Competitions were organized for the employees of IPR, FCIPT & ITER-India on Slogan writing in Gujarati, Hindi & English, Quiz and Essay Writing in Gujarati, Hindi & English based on the decided theme. Overwhelming response was received from the employees for these competitions. In addition to this, safety division also conducted demonstration of firefighting equipment for the employees during this week. A talk on "Periodic Hydrostatic Testing, Inspection, Safety and Certification of High Pressure Helium Gas Cylinders of IPR" was delivered by Shri Rajiv Sharma.

The Concluding Session was conducted on 8th March 2024 at IPR, during which, a welcome address delivered by Shri Devendra Modi. This was followed by a talk on "Safety Measures and Precautions-CWS Project Execution" delivered by Shri Rakesh Ranjan & Shri Rohit Agrawal. Some thoughts on safety were delivered by Dr. Paritosh Chaudhuri, Dean (R&D). He emphasized that safety should be an integral part of the future vision and technology and that one must create a culture of safety where safety is not just a matter of compliance, but a way of life. He congratulates the winners of various competitions and safety committee for organizing this event. This was then followed by a Safety Pledge administered by Dr. Rajesh Kumar, Member – Safety Committee. Prizes were then distributed to the winners of the various competitions. Shri Dinesh K. Gupta, Member - Safety Committee, delivered the vote of thanks to mark the end of the event.

53rd National Safety Week Campaign 2024 at CPP-IPR

CPP-IPR celebrated the 53rd National Safety Week Campaign to promote safety awareness among its staff members. The celebration included Safety Awareness Slogan, Essay, and Quiz competitions. The Slogan & Essay competitions were conducted in three languages (Assamese, Hindi, and English) based on this year's theme, "Focus on Safety Leadership for E.S.G. Excellence (Environmental Social Governance)," as decided by the National Safety Council of India. The competitions received a positive response from the staff members. The Slogan and Essay competition was held on 29th February 2024. The Quiz competition was held on 4th March 2024. The concluding session took place on 11th March 2024. Mr. A. Baishya delivered a General Safety Awareness talk, followed by award distribution ceremony.

International Women's Day Celebration 2024 at IPR

International Women's day (IWD) is celebrated globally on 8th Match, every year to celebrate the achievements of women and mark a call to action for gender equality. Abiding by guidelines issued by Government of India, IPR also celebrated "International Women's Day 2024" with all colours and global spirit from 7th March - 15th March, 2024.

Various activities were organized at IPR to create awareness, strength and women empowerment. In order to maximise the participation among all the members of IPR, FCIPT, ITER-India and CPP-IPR, all the activities were conducted in offline as well as online modes. More than 150 staff

members participated in the entire celebration. Male colleagues of the Institute also participated as audience as well as speakers, sharing their thoughts on IWD.

7th March, 2024 marked the inaugural function with lighting of lamp, with invited guests Dean Admin (Dr. Subroto Mukherjee), Dean R & D (Dr. Paritosh Chaudhary), Dr. Rajesh Kumar & Dr. Ranjana Gangradey. Dean Admin, Dr. Mukherjee shared encouraging thoughts on Women empowerment and evolution of Women and their recent contributions in Global Industries and Societies. This was followed by an energetic talk delivered by Ms. Shivangi Desai, a certified Health and Nutrition coach from Ahmedabad on "Healthy lifestyles and Healing with Emotions". Another important talk was arranged on Finance management (especially for Women) delivered by Ms. Falguni Shah, Accounts Officer, IPR.

Celebration on 8th March, 2024 began with homage to Late Prof. Bimla Buti, followed by cultural events and Hindi poetries. Among the various activities during IWD celebration, a special session was arranged where experienced Women Scientists of IPR shared their personal and professional journey, motivating younger generation to rise beyond difficulties.

On 11th March, 2024 IWD celebration continued with an invited guest, Dr. Moumita Dutta, from Space Application Centre (SAC), Ahmedabad. Her interactive and motivational talk on "Evolution of Dashabhuja': Blending work and family in unison" showcased contribution on Women Scientists in various missions of ISRO. Dr. Moumitta Dutta visited SST-1 and ADITYA and interacted with younger colleagues. A special lunch was organized for all the IPR Women Staff at IPR Guest House.

The concluding session of International Women's day was held on 15th March, 2024. The invited speaker was Dr. Arti Sarkar, Group Director, SAC Ahmedabad on "My journey in developing Optical payloads and their significance in Space missions". Apart from IPR Women staff, students as well as IPR male staff also participated attended and interacted with the speaker during the talk. Ms. Anita Patel, Ms. Snehlata Aggarwal and Ms. Shilpa Khandker read inspirational Hindi poetries celebrating the spirit of Women's Day. At the end of the ceremony, Dr. Ranjana Gangradey presented vote of thanks and Memento to the invited speaker from SAC, Ahmedabad. She also shared her experience and association with ISRO while interacting with the speaker on the dais. Dr. Arti Sarkar visited SST-1 and interacted with some of the working group members.

Plasma Exhibition @ Shillong (Meghalaya)

Institute for Plasma Research (IPR), Gandhinagar (Gujarat), in association with Sankardev College, Shillong (Meghalaya), organized an exhibition on Plasma, the fourth state of matter during 11-15 March, 2024. This program is part of IPR's rural scientific outreach activity in various states of India. This is the second outreach activity of IPR to be held in the state of Meghalaya. The programme consisted of an exhibition on plasma, its applications as well as introductory talks on plasma for visiting students. The event was inaugurated by Dr. Eureka F. P. Lyngdoh, Principal, Sankardev College. For this exhibition, 50 students of various BSC courses of Sankardev College were trained by IPR team to explain the exhibits to visiting students in their local language. The concluding session on 15-Mar-2024 was graced by the Chief Secretary to the Govt. of Meghalaya and State Vigilance Commissioner, Shri Donald Phillips Wahlang, IAS, who also spent time visiting the exhibits and interacting with the

student volunteers. Over 1500 students and general public visited the exhibition at the Sankardev College. IPR's Outreach event at Shillong was coordinated by Mr. J. Choudhury and Dr. Sylvia Badwar of the Department of Physics, Sankardev College. Staff and research scholars from CPP-IPR also participated in this event.

Plasma Exhibition @ Hojai (Assam)

Institute for Plasma Research (IPR), Gandhinagar (Gujarat), in association with Rabindranath Tagore University (RTU), Hojai (Assam), organized an exhibition on Plasma, the fourth state of matter during 18-22 March, 2024. This program is part of IPR's rural scientific outreach activity in various states of India. This is the first outreach activity of IPR to be held in rural Assam. The programme consisted of an exhibition on plasma, its applications as well as introductory talks on plasma for visiting students. A quiz program was conducted for school students and Tokomak assembly competition was also conducted for the volunteers.

The event was inaugurated by Prof. Amalendu Chakrabarty, Vice Chancellor, Rabindranath Tagore University. For this exhibition, 100 students of various BSc courses of RTU were trained by IPR team to explain the exhibits to visiting students in their local language. Over 650 students and general public visited the exhibition at RTU. IPR's Outreach event at Hojai was coordinated by Dr. Swathi Baruah and Dr. Laba Kumar Thakuria of the Department of Physics, Rabindranath Tagore University. Staff and research scholars from CPP-IPR also participated in this event.

CPP-IPR's participation at North East Startup and Entrepreneur Conclave, 2024

The outreach cell of CPP-IPR participated in the "North East Startup and Entrepreneur Conclave, 2024" held at Srimanta Sankaradeva Kalakshetra, Guwahati from 27th to 28th March, 2024. The conclave was organized by North East Centre for Technology Application and Reach (NECTAR) with the aim to display the vibrancy of the Northeast startup ecosystem, bringing together stakeholders to unite, investments, innovation and connectivity. In the CPP-IPR stall, few working models of plasma as well as posters on various applications of plasma were displayed. The various applications of plasma and the potential of creating startups based on plasma technologies were also explained to the visitors.

E.1. Outreach

Institute's Outreach conducted several scientific outreach activities (both in rural and urban locations) across the country during this period. As part of the outreach activities, plasma exhibitions were conducted at 13 locations across the country in the states of Gujarat, Delhi, Tamil Nādu, Mizoram, Tripura, Karnataka, Kerala and Himachal Pradesh. These events consisted of an exhibition on plasma, its applications and nuclear fusion with over 25 exhibits, most of which being working, interactive models and popular talks on plasma & its application for general public. Training program in plasma science & technology for science teachers was also conducted during many of these events. Over 700 students from the host institutions were trained to explain the exhibits to visitors during the exhibitions. These events have seen a net footfall of over 4 lakh visitors, which includes around 35,000 students and teachers from over 740 schools and colleges. Instute's exhibition stall won the "Best Innovation Exhibit" award at the Science Carnival 2023 organized by the Gujarat Government. Around 240 teachers were trained in plasma and its applications during the outreach events.

Figure E.1.1: IPR receiving the "Best Innovation Exhibit" award at the Science Carnival 2023.

To involve participation from more students, competitions such as quiz, Tokamak gaming as well as Tokamak assembly competitions were organized during the outreach events which were received with great enthusiasm.

Institute's outreach also celebrated the National Technology Day event in association with the L.D. College of Engineering, Ahmedabad during May 2023. This event saw participation of over 1000 engineering students from across the state of Gujarat.

A “Remote Plasma Experiment” was developed by IPR Outreach which enables students to remotely operate a glow discharge plasma system using the internet. This will give students from schools an opportunity to actually operate a plasma experiment. This will also be a testing platform for developing more complex plasma experiments that could be operated remotely by students.

Figure E.1.2: Hon. Chief Minister of Gujarat, Shri Bhupendrabhai Patel and Shri Raj Kumar, Chief Secretary, Govt. of Gujarat, visiting the exhibition.

Outreach Division has also created resource materials related to plasma for distribution to students. The most popular one being the comic book on plasma for school children that is now available in English and 13 Indian languages. Translations into foreign as well as other vernacular Indian languages are in progress.

Outreach Division has also meticulously documented all the outreach events conducted by

it and has produced over 20 short videos of the events. The Outreach website also has up-to-date information about the events and a repository of resource materials and details about the exhibits for students to download and use.

A solar telescope capable of observing detailed surface features of the sun was established by IPR outreach. Solar observation sessions for school students are planned to be organized at IPR campus as well as at the campuses of rural schools. Solar observation camps are also planned to be organized for school students during vacation time.

During this period, IPR Outreach facilitated academic visits to IPR/FCIPT from 46 schools/ colleges with over 3000 students in more than 60 academic visits.

In February 2024, IPR will organize the National Science Day for school students from across Gujarat state. More rural outreach activities are planned in the state of Gujarat and other states of India in 2024.

Virtual Reality contents related to plasma and fusion are being developed by IPR Outreach for showcasing various experimental systems as well as concepts of fusion to students. On a regular basis the in-vessel and the outer view of SST-1 is shown to the students and visitors on outstation events in order to provide the viewers with a general understanding of a Tokamak.

A few new exhibits have been added into the assets of Outreach, like, a model of the Tritium Breeding Blanket and a functional setup showing the Radiation Induced Discharge

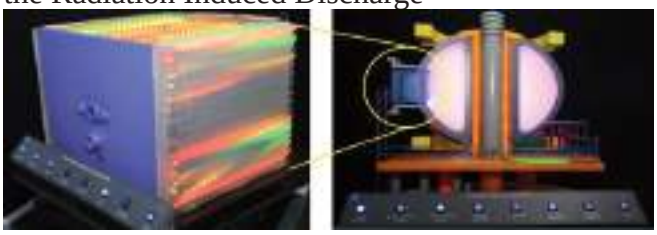


Figure E.1.4: A model depicting the tritium breeder.

Figure E.1.5: The radiation induced discharge.

IPR Outreach participated in 9th India International Science Festival (IISF-2023), Solar events organized at SVP University (VVN) and CVM University in Anand (Gujarat) in December 2023 and January 2024, Science Week-2024 held as part of the 100th birth anniversary of Shri Balvantray Parekh during 22-24 February in Bhavnagar, the annual Science Carnival hosted by the Gujarat Science City as part

Figure E.1.3: Students watching SST-1 through the virtual reality.

of the Science Day celebrations of the Govt. of Gujarat, from 28-February to 3-March 2024 at the Gujarat Science City, Ahmedabad, events from 11th March to 22nd March in Shillong (Meghalaya) and Hojai (Assam) in association with Rabindranath Tagore University (RTU). This is the first outreach activity of IPR to be held in rural Assam.

On 10th and 11th February 2024, the National Science Day was organized in IPR under the auspices of the Platinum Jubilee Celebrations of Department of Atomic Energy, Government of India. Competitions like Essay, Poster, Quiz, Skit and Eloquence had been conducted for the students from standard 8th to 12th. More than 50 and 6 science models had been demonstrated by the students and their teachers respectively. Souvenirs (Tokotoy and plasma calendar) had been distributed among teachers. Following statistics indicate the enthusiasm among visiting students, their teachers and the general public:

Figure E.1.6: A glimpse of IISF festival in IPR.

Figure E.1.7: Solar observation event organized at the Charutar Vidya Mandal University, Vallabh Vidyanagar.

Figure E.1.8: Images from the solar observation event organized at S. P. University, Vallabh Vidyanagar, Anand (Gujarat).

Figure E.1.9: Rolling trophy awarded to St. Xavier's High School, Gandhinagar.

Figure E.1.10: Organizers & student volunteers with IPR Outreach Team.

No. of participating schools	44	No. of events organized	07
No. of participants (Students)	365	No. of prizes awarded	21
No. of participants (Teachers)	80	No. of visitors	3000

Figure E.1.11:Ms. Mona K. Khandhar, IAS, Principal Secretary, Dept of Sci. & Tech., Govt of Gujarat, inaugurated & visited the IPR stalls.

Figure E.1.12: The plasma exhibition at Sankardev College, Shillong.

Figure E.1.13: Students understanding the notion of pyrolysis and the virtual reality in Shillong.

Figure E.1.14: Inauguration of the event by the Vice Chancellor, Rabindranath Tagore University.

E.2 Official Language Implementation

In the 20th half-yearly meeting of the Town Official Language Implementation Committee held on 28 April 2023, Institute for Plasma Research, received the shield and certificate as first prize in the Official Language Shield Competition for excellent work in the implementation of the official language for the year 2022.

ATOLIS Incentive Scheme: ATOLIS Scheme of DAE has encouraged the employees to work in Hindi and the staff members are getting benefits according to their work done in Hindi. The total cash prize of Rs 41,900 for the quarter April-June 2023; the total cash prize of Rs 46,200 for the quarter July-September 2023; the total cash prize of Rs 44,900 for the quarter October- December 2023 and in the January- March 2024 quarter, a total cash prize of Rs 41,400, has been awarded to the employees.

National Hindi Scientific Seminar was organized by the institute on 20th and 21st July 2023 on the topic "Nuclear Energy and its Contribution to Society". A total of 38 oral presentations were given in this two-day seminar, in which representatives of Bhabha Atomic Research Centre, BRIT, Indira Gandhi Atomic Research Centre, Directorate of Atomic Minerals Exploration and Research, Nuclear Power Corporation of India Limited, Electronics Corporation of India Limited, Variable Energy Cyclotron Center, Atomic Energy Regulatory Board, Raja Ramanna Center for Advanced Technology, Kendriya Vidyalaya of Atomic Energy, Institute of Physics, Institute for Plasma Research and its associate organizations – FCIPT and ITER participated. This seminar was organized through hybrid mode, which included 6 presentations through online medium.

The 31st and 32nd issues of the institute's Hindi magazine 'Plasma Jyoti' were e-published and 12 issues (April 2023 to March 2024) of the Hindi Newsletter 'Plasma Samachar' were e-published.

Shri Ravinder Kumar, Scientific Officer-E from the Institute participated and gave oral presentation in the All India Hindi Scientific Seminar – 2024 organized by Indira Gandhi Atomic Research Centre, Kalpakkam on 10-11 January 2024. Shri Ravinder Kumar has received the second prize for excellent presentation in this seminar.

Hindi Training: Training was provided once a week by the Hindi section to the nominated personnel of the institute for the Prabodh and Praveen Hindi examination conducted under the Hindi Training Scheme. 11 personnel have passed Hindi Examination (Prabodh-2, Praveen-2, Parangat-7).

As per the instructions of the Department of Official Language, Ministry of Home Affairs, this year Hindi Fortnight was celebrated in the institute from 18 September 2023 to 04 October 2023 by the Hindi Competition Committee under aegis of the Official Language Implementation Committee, under which technical and non-technical article writing competition, slogan writing, noting, Letter writing and translation, crossword puzzle,

scientific/technical video, Hindi computer typing, Hindi quiz, interesting story writing (for employees and family members), interesting story presentation, self-written poetry recitation and Hindi singing competition were organised. In which more than 300 employees of the institute participated. The closing ceremony of the Hindi Fortnight celebration was organized on 4 October 2023.

As a part of "Taknik Ke Saath, Vigyan Ki Baat" Hindi talk series, a Hindi Talk was organized in the Seminar Hall on 02 December 2023. On this occasion, Dr. Subroto Mukherjee, Senior Professor-H and Dean, Administration delivered a talk on the topic "LIGO– for the detection of gravitational waves".

During this year "Swachhta Hi Seva" campaign, National Science Day 2023, World Hindi Day, Vigilance Awareness Week, Anti-Ragging Day/ Week, International Women's Day, 53rd National Safety Week etc. programmes were organised in IPR, FCIPT, CPP-IPR and ITER-INDIA, in which various Hindi competitions/activities/skit were organised.

A Hindi workshop was organized in the institute on 21.04.2023 on the topic "Can science be comfortable in Hindi? This workshop was conducted by Shri Raj Singh, Scientific Officer-H and Co-Chairman, OLIC.

In the Hindi workshop organized on 8th June 2023 at Central Public Works Department (CPWD), Gandhinagar, training was given on the subject of "Hindi Noting and Drafting" by the Hindi Officer of the Institute.

In the Hindi workshop organized on 28 June 2023 at National Forensic Science University (NFSU), Gandhinagar, the Hindi Officer, IPR gave training on the topic "Measures for using Hindi on Computer".

A talk on "Do's and Don'ts as per Central Civil Services (Conduct) Rules" was organized in the Seminar Hall of IPR for the newly recruited employees of the Institute on 5th September 2023. This event was also broadcast online. This topic was extensively discussed by the Shri Niranjan Vaishnav Chief Administrative Officer, IPR.

The employees of the institute participated in the online quiz competition organized by the Central Water Commission, Gandhinagar under the aegis of the TOLIC Official Language Implementation Committee, Gandhinagar on 22.03.2024.

A Hindi talk for the member offices of TOLIC, Gandhinagar was organized by Institute for Plasma Research, under the aegis of TOLIC, Gandhinagar, on 2nd November 2023. Dr. Nirav Jamnapara, Scientific Officer of the Institute, gave the talk on the topic "Importance of Plasma in Common Life". After the talk, personnel from member offices of TOLIC, Gandhinagar visited Aditya-Upgrade and SST-1 laboratory.

World Hindi Day celebration was organized in the institute on 10 January 2024. Shri Krishna Gupta, Raja Ramanna Fellow, eminent scientist and former Officer on Special Duty, Department of Atomic Energy, was invited to deliver a talk on this occasion. Shri Krishna Gupta extensively discussed on the subject of "Contribution of Department of Atomic Energy in India's self-reliant programme".

National Science Day was organized on 10-11 February, 2024 under the auspices of the Platinum Jubilee Celebrations of the Department of Atomic Energy (DAE). More than 350 students and 80 teachers from 44 schools participated in this 2-day event. On the occasion of National Science Day, essay, elocution and short drama competitions in Hindi were also organized for school students in the institute.

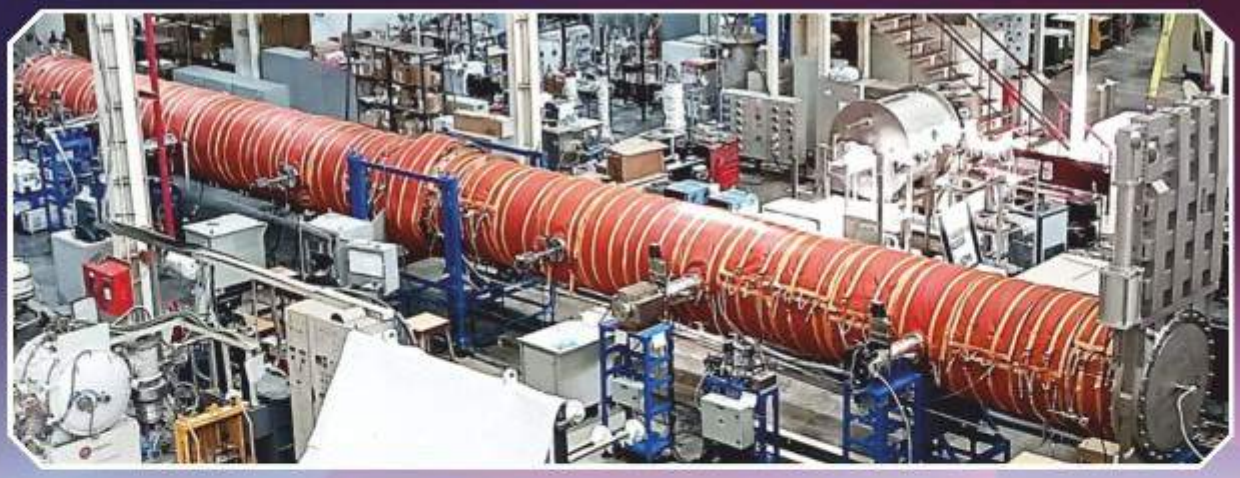
Eight articles of Ms. Pratibha Gupta, Scientific Officer-F of the Institute have been published in the quarterly Hindi magazine "Vigyannik" of the Hindi Vigyan Sahitya Parishad.

Hindi Inspection: During this period, Official

Language Inspection Committee of the IPR Gandhinagar did Hindi inspection of the CPP-IPR, Guwahati and three sections of the IPR.
Translation work: Translation of Annual Report 2022-2023, Translation of Activity Report 2022-23, Translation of Outcome Budget, Translation of Section 3(3) documents and various correspondences were translated during this period. Special efforts are being made for the promotion of the official language and various activities are being carried out by the institute, so that gradual progress can be made towards the implementation of the official language.

E.3 Right to Information

During the report period 2023-24, a total of 193 RTI applications were received, out of which 188 were of new RTI Application, while the other 05 were of Appeal nature. All of them have been disposed off by the Public Information Officer and Appellate Authority concerned within the prescribed time-limit.

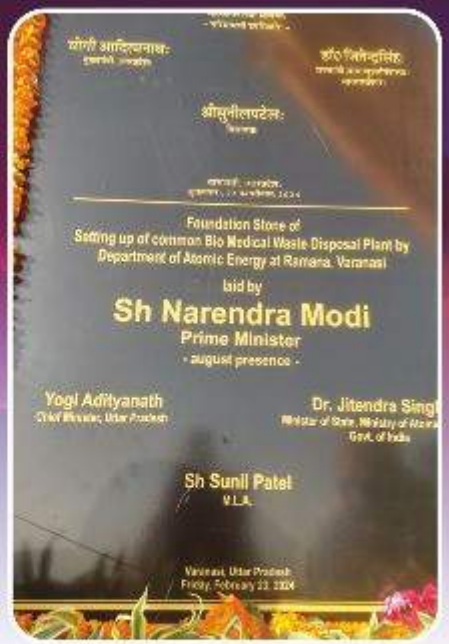


आईपीआर लीगो लैब में 20 मीटर का एकीकृत वैक्यूम वेसल
20 m integrated vacuum vessel at IPR LIGO Lab

ईटर-भारत जायरोट्रॉन परीक्षण सुविधा में जायरोट्रॉन सेटअप
Gyrotron set up at ITER-India Gyrotron Test Facility

हाइपर रिडंडेंट निरीक्षण प्रणाली
Hyper Redundant
Inspection System

ABB रोबोट को नियंत्रत करने वाला हेप्टिक फोर्स फीडबैक आर्म
Haptic Force Feedback arm
controlling ABB robot



माननीय प्रधानमंत्री जी द्वारा वाराणसी में साझा जैव-चिकित्सा अपशिष्ट निपटान संयंत्र की स्थापना के लिए आधारशीला रखी गई

Foundation stone for setting up of Common Biomedical Waste Disposal Plant at Varanasi laid by Honourable Prime Minister

आभासी वास्तविकता के माध्यम से एसएसटी-1 को देखते हुए छात्र

Students watching SST-1 through the virtual reality

आईपीआर को साइंस कार्निवल 2023 में "सर्वश्रेष्ठ नवाचार प्रदर्शनी" पुरस्कार प्राप्त हुआ

IPR receiving the "Best Innovation Exhibit" award at the Science Carnival 2023