

Issue 096
July 2021

The Fourth State

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

International Yoga Day 2021

The 7th edition of International Yoga Day was celebrated with great enthusiasm by IPR staff. Because of the Covid-19 restrictions, no physical yoga meet was organized on campus. However, IPR Staff Club organized a "Yoga & me" campaign on this occasion wherein IPR staff members posted photos of themselves and/or their family members performing yoga exercises and a detailed description of the asana. A virtual yoga session was also organized on 21 June 2021 by yoga trainer Shri. Vivek Sharma. A slogan writing competition for IPR staff members and/or their family members was also organized as part of the IYD 2021. The theme for the slogan competition was "Yoga for better immunity" in Hindi, Gujarati or English.



Images from the "Yoga & Me" campaign organized by IPR Staff Club on the occasion of the International Yoga Day, 2021

Language	First Prize	Second Prize	Third prize
Hindi	रोग का प्रतिकारण हो जाएगा आसान, यदि जीवन में योग को दे उचित सम्मान - Abha Maheshwari	“योग कोई संजोग नहीं , स्वास्थ्य के लिए योग ही सही ” - Sunil Misal “योग अपनाओ स्वस्थ रहो और मुस्कुराओ, यह मूल मंत्र जान जान तक पहुँचाओ” - Amit Yadav	“स्वास्थ्य है सबसे बड़ा उपहार, जो योग से होता है साकार” - Vijay Gaur “योग का नियमित उपयोग, निरोगी काया देश आरोग” - Mukesh Jha “योग रखे निरोग , बढ़ाये रोग प्रतिरोध, इसलिए अवश्य करें प्रेम से प्रयोग” - L N Gupta
English	“Depression & illness hits your immunity, But, Practicing Yoga provides you impunity.” - Rohit Anand	“Herd immunity may takes time let's do yoga for long life immunity” -Arun Panchal	“For Healthy body and healthy mind, Let's do yoga with all our might Yoga sets you free It's for all not just you and me” - Dhaval Bhavsar
Gujarati	બનો યોગ યુક્ત , રહે રોગ મુક્ત -Gaurang Mehsuria	“જે તમે યોગા કરો ભરપૂર, તો બધા રોગો ભાગી જાય દૂર. યોગા છે એક એવી એક આસ, કે રોગ કોઈ નહી આવે પાસ” -Raj Singh “નનયનમત યોગ કરવાનો આજેજ લઈએ સીકલ્પ, સ્વસ્થ રહેવાનો આ જ છે નવકલ્પ” - Haresh Chandwani (Spouse of Nisha Chandwani)	“અપનાવો યોગનેઆપના જીવનમાં, સકારાત્મક ઉજા અવતરશેતન મન માં” - Jahnavi Dave (Daughter of Purvi Dave)

Results of the Slogan Competition organized by the IPR Staff Club on the occasion of International Yoga Day



Images from the “Yoga & Me” campaign organized by IPR Staff Club on the occasion of the International Yoga Day, 2021



Images from the online yoga session.

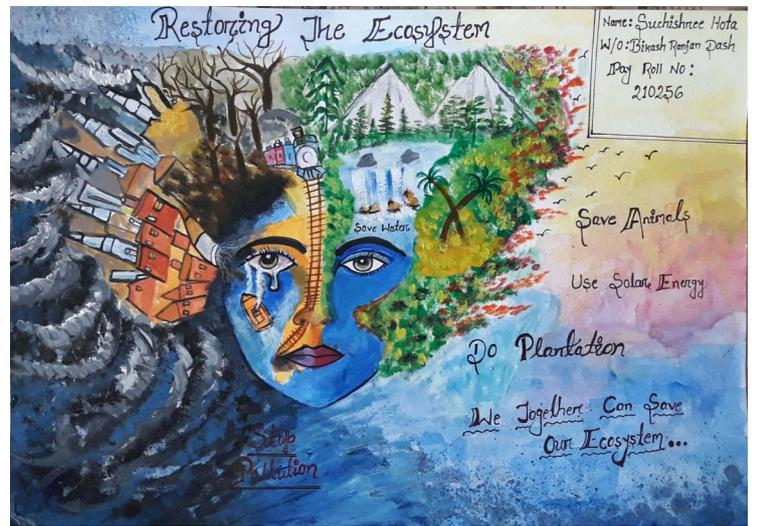


Images from the online yoga session.

World Environment Day 2021

IPR Staff Club celebrated the World Environment Day on 5th June 2021 organizing various Online Competitions (slogan writing, essay writing and poetry writing) for IPR staff and their family members on the UN theme for this year's Environment Day "Restoring the Eco-system".

Competition	1 st Prize	2 nd Prize	3 rd Prize	Special Appreciation
Poster	Sampriya Bandyopadhyay	Suchshree Hota	Bhawana T. Sharma Arnav Singh	Ananya Sanyasi Khushi C Bhavsar Nidhi Garg
Poem	Arunsinh Zala	Pieu Bandhyopadhyay	Manaswi Bhuyan R. Bhatasana	
Essay	Swayamsiddha Mishra V.K.N Saketh N C Patel	Prateek Garg	Minsha Shah Pratibha Gupta	Radhika



Some of the prize winning posters of the World Environment Day 2021

Blobs play an important role in the edge plasma dynamics and are believed to contribute towards the anomalous and intermittent nature of plasma transport in the edge region. Over the past years, a large number of theoretical and experimental studies have been devoted towards investigations of their dynamical origin, their physical characteristics and their role in the edge transport.

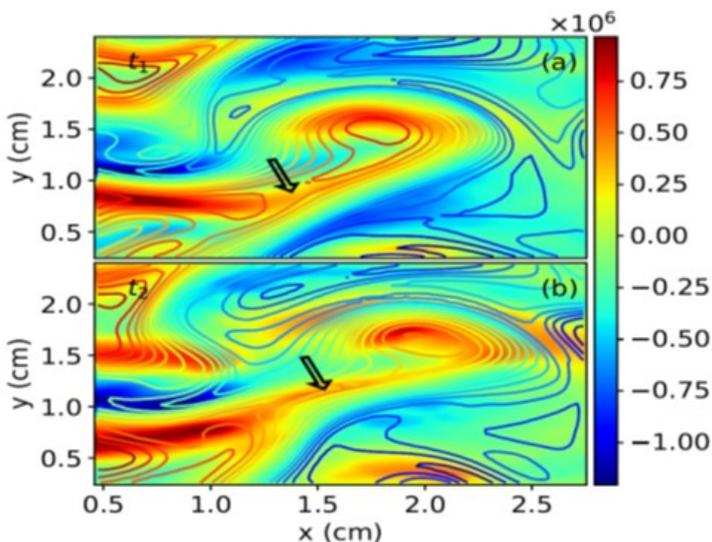
These studies have shown that blobs form in the edge or near the edge-to-SOL transition region where the shear of the radial electric field is high. More recently, the role of radial shear of the poloidal electric field in the presence of radial shear of the radial electric field has been identified as an important ingredient in the blob formation mechanism.

These shears cause a differential stretching of a streamer structure in the radial and poloidal directions and when the rate of the stretching exceeds the growth rate of the interchange modes the streamer breaks and gives rise to a blob. Most of the above theoretical investigations on blob formation have been carried out under the simplifying assumption of a uniform background electron temperature. While such an assumption might be reasonable for most L-mode discharges, however, it is not valid for H-mode discharges and may not always hold even for L-mode discharges.

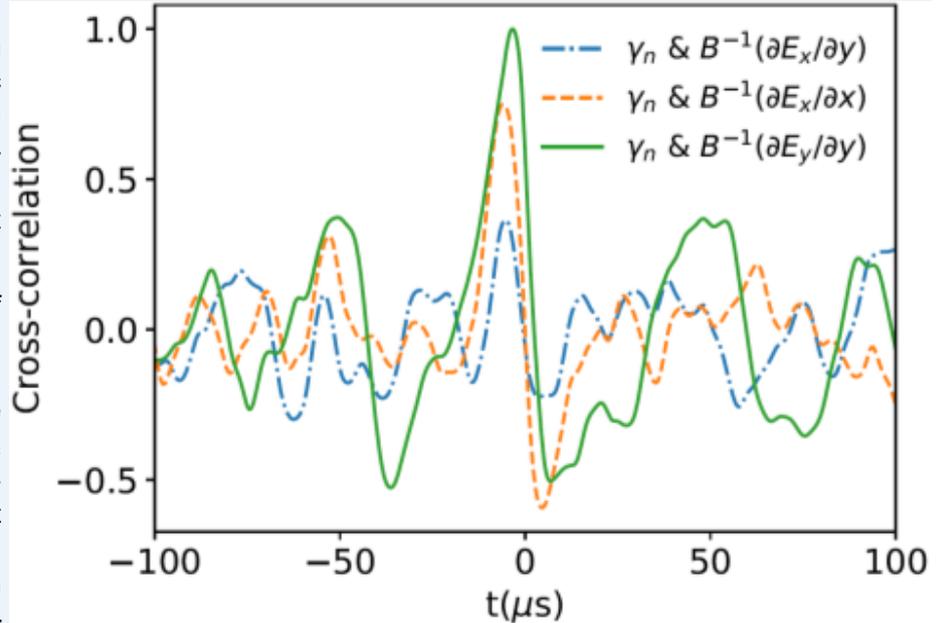
It is speculated that electron temperature and its gradient may play an important role in the edge plasma dynamics. A radial gradient of electron temperature can lead to a zonal flow shear near the last closed flux surface (LCFS) in the SOL region that can stabilize the edge turbulence and take the plasma into an H-mode operation. Electron temperature and its radial gradient may also be important in the L-mode through their contributions to the monopolar component of the electrostatic potential in a streamer.

Thus, the formation of a blob from the breaking of a streamer structure either in the L-mode or H-mode can be significantly influenced by contributions from electron temperature and its gradient. In this work to see the effect of electron temperature and its gradient, we have derived analytically a general criteria of blob formation as ;

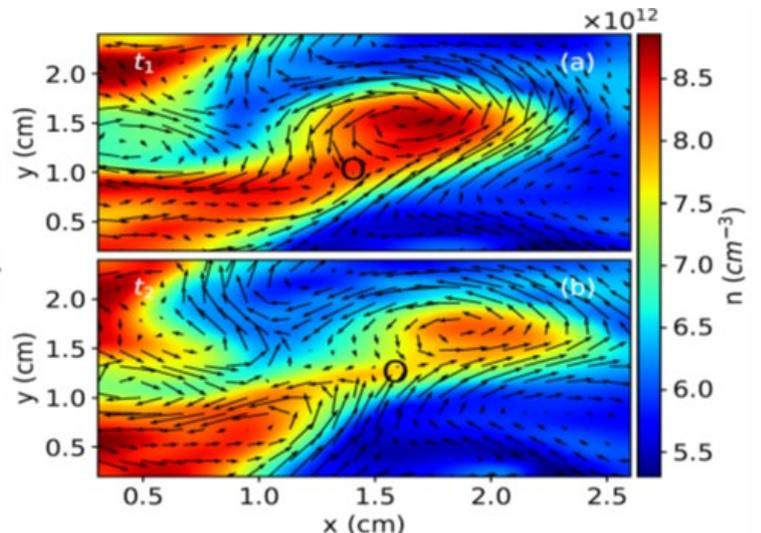
$$\frac{\delta_x}{\gamma B \delta_y} \frac{\partial E_x}{\partial x} + \frac{1}{\gamma B} \frac{\partial E_y}{\partial x} + \frac{\delta_y}{\gamma B \delta_x} \frac{\partial E_y}{\partial y} \geq 1$$



Superposition of plasma density (contour) and $\partial E_y/B\partial y$. The shear $\partial E_y/B\partial y$ becomes maximum at point (1.38 cm, 0.8 cm) during breaking at t_1 as shown in (a). After breaking at t_2 shown in (b).



Cross-correlation between γ_n (non-linear growth rate) & $\partial E_x/B\partial x$, γ_n & $\partial E_x/B\partial y$, and γ_n & $\partial E_y/B\partial y$. The cross-correlations becomes the highest for γ_n & $\partial E_y/B\partial y$.



Superposition of plasma density and quiver plots for the radial and poloidal velocities at $z=157.08$ cm. The breaking positions are shown by "O".

ITER-India Update : Gyrotron Main High Voltage Power Supply

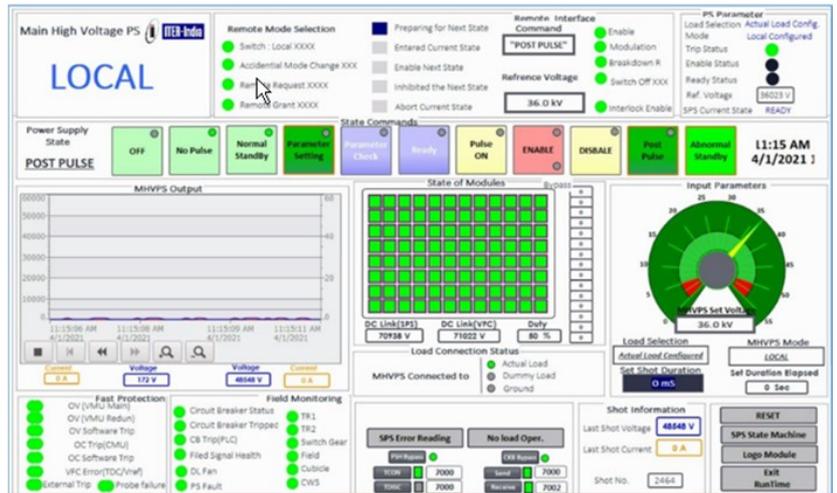
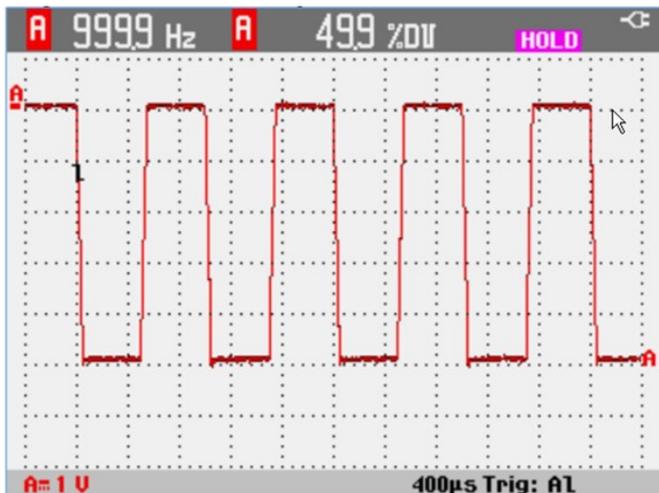
ITER-India Power Supply Group has developed and installed Main High Voltage (55kV, 6MW) Power Supply (MHVPS) for Gyrotron test facility of ITER-India and IPR; the power is to be fed to cathode of Gyrotron. MHVPS is developed with specific feature of soft charging at input 22kVAC side to limit inrush charging current.

Power supply is based on PSM (Pulsed Step Modulation) technology; capable to feed settable voltage with $\pm 0.5\%$ accuracy from 10kV to 50kV. In-house developed Zynq 702 based controller controls power supply for operation, can switch off within $10\mu s$ in case of short circuit. Operation GUI runs on Siemens PLC 1500, which supports Ethernet interface to higher level (Gyrotron) controller.

MHVPS is successfully demonstrated for 50kV, 1kHz modulation along with protection and functional parameters in line with ITER specification of EC MHVPS. This power supply is now ready for integration with the Gyrotron.



(Above & Below) The MHVPS installed at ITER-India Power Supply Lab



(L) MHVPS operation with dummy load (R) The GUI of the control software

Obituaries



Professor Dhiraj Bora
(30-Sept 1951– 19-June 2021)

Professor Dhiraj Bora, Ex-Director, IPR, passed away at Ahmedabad on 19th June 2021 after a cardiac arrest.

After his Masters in experimental physics from Moscow USSR, he joined the Physical Research Laboratory, Ahmedabad for his PhD, and later, he was associated with the Plasma Physics Programme right from its inception in the early 1980s.

For more than four decades, he was actively involved in various aspects of tokamak research, which also included advanced RF technologies at IPR.

He was appointed the Deputy Director General at ITER, France during 2006-2011 after which, he returned to India and took over as Director, IPR until his superannuation in 2016. He then took up the position of Vice-Chancellor of the Assam Science & Technology University (ASTU) at Guwahati.

He is a recipient of the Kamal Kumari National Award for Science and Technology in the year 2012. Prof. Bora was also conferred the Life Time Achievement Award in the 4th International Conference on Environment and Ecology in Guwahati University, Assam by the Confederation of Indian Universities, New Delhi in 2018. Prof. Bora has also served as the Treasurer, Secretary, and President of the Plasma Science Society of India (PSSI).

He is survived by his wife Rita and daughter Priyanshi.

On behalf of all the staff members of IPR, FCIPT, ITER-India and CPP-IPR, we pray that his soul rests in eternal peace!



Shri. Jayesh V Raval
(10-Sept-1981 - 28-May 2021)

Shri Jayesh Raval, Scientific Officer D, passed away on 28th May, 2021.

After having worked as temporary scientific staff at IPR in the Beam Surface Interaction group during 2006-08, Jayesh was employed at the Gujarat Science City in Ahmedabad for a while, from where he quit to take up a permanent position in IPR in May 2011 as Scientist SC in the X-Ray diagnostics group.

Jayesh was a very enthusiastic, active resourceful and hard working person, and he always gave his best to independently accomplish the tasks assigned to him. Always smiling, he was extremely cooperative and helpful with coworkers and possessed a deep motivation towards a research oriented career.

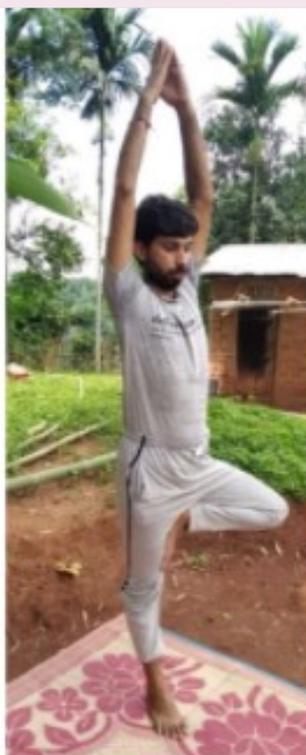
During his early days at IPR as a temporary staff, he always expressed that joining IPR as a scientist was his ultimate dream.

IPR and the plasma science & fusion community has indeed lost a very young and dynamic scientist.

He is survived by his wife Pooja and daughter Vidhya.

On behalf of all the staff members of IPR, FCIPT, ITER-India and CPP-IPR, we pray that his soul rests in eternal peace!

The Covid-19 restrictions in Guwahati did not permit the IYD-2021 to be celebrated on campus. Staff members participated in the “Yoga & me” campaign and Shri Manoj Kumar Deva Sarma of CPP-IPR, who practices yoga on a regular basis gave a full demonstration of various asanas relevant to our day to day life.



UPES “Science Series” Lecture



The University of Petroleum and Energy Studies (UPES), Dehradun in association with Institute of Physics (IOP), Indian Physics Association (IPA) and the Indian Association of Physics Teachers (IAPT), organized a lecture series on “Science Series” by eminent scientists from India and abroad. Dr. Shashank Chaturvedi gave an online lecture entitled “Technological Applications of Plasmas” in this lecture series on 10 June 2021.

- ◆ **Talks presented at 28th IAEA Fusion Energy Conference (FEC 2020) (Virtual), 10-15th May 2021**
 - “Lithium Wall Conditioning Techniques in Aditya-U Tokamak for Impurity and Fuel Control” by K.A. Jadeja
 - “A Numerical Simulation of Self Consistent Dynamo using a New GPU-Based 3D MHD Solver” by Shishir Biswas
 - “Entrapment of impurities inside a cold trap: A purification process for removal of corrosion impurities from molten Pb-16Li” by Ankush Deoghar
 - “Performance of High Heat Flux Test of Positive Ion Neutral Injector Ion Source Back Plate” by M. R. Jana
 - “First Laboratory Observation on Controlled Mitigation of Energetic Electrons by Whistlers” by A. K. Sanyasi
- ◆ **Talks presented at 2nd International Conference on Advances in Plasma Science and Technology (ICAPST-21), Sri Shakthi Institute of Engineering and Technology, Coimbatore, 27-29th May 2021**
 - “Capacitively coupled plasma discharges excited by tailored waveform - a simulation study” by Sarveshwar Sharma
 - “Anode fireball for making super-hydrophobic nanodot surfaces” by Mukesh Ranjan
 - “Numerical study on the effect of plasma density on Runaway Electron suppression in the ADITYA-U tokamak” by Ansh Patel
 - “First results of recently developed prototype Magneto-Optic Current Sensor (MOCS) diagnostic for plasma current measurements in ADITYA-U tokamak” by Santosh P. Pandya
 - “Conceptual Design of Multichannel FEB Detection System to Study Suprathermal Electron Dynamics during Lower Hybrid Current Drive (LHCD) in ADITYA-U Tokamak” by Jagabandhu Kumar
 - “Computational modeling on Cu-Ni alloy evaporation in DC free burning arc plasma” by G D Dhamale
- ◆ **Dr. Sabbir Ahmed**, gave a talk on “MOLFLOW+ tools for UHV System” on 28th May 2021
- ◆ **Dr. Abhijit Boruah**, gave a talk on “Investigation of plasma dynamics in a non-thermal plasma reactor for exhaust gas treatment” on 2nd June 2021
- ◆ **Dr. Pallabi Pathak**, gave a talk on “Investigations on the modulational instability of ion wave in a negative ion plasma sources” on 4th June 2021
- ◆ **Dr. P. N. Maya**, gave a talk on “Studies on Energetic Particles and Consequences for Next Step Reactors” on 4th June 2021
- ◆ **Mr. Aroh Shrivastava**, gave a talk on “Compatibility study between Li_2TiO_3 and India specific reduced activation ferritic martensitic steel” on 4th June 2021
- ◆ **Dr. Pravin Kumar Tiwari**, gave a talk on “Analysis of trace/impurity elements in the materials using LIBS technique” on 8th June 2021
- ◆ **Dr. Janki Shah**, gave a talk on “Super-Hydrophobic Nano-Silica Powder Spray for Water-Repellence” on 11th June 2021
- ◆ **Dr. Arkaprava Das**, gave a talk on “Comparative study between gas and liquid medium synthesized nanoparticles with thermal plasma method” on 21st June 2021
- ◆ **Dr. Sandip Dalui**, Jadavpur University, Kolkata, gave a talk on “Some Problems on Nonlinear Ion Acoustic Waves in Two Electron Temperature Plasma” on 21st June 2021

Upcoming Events

- ◆ 5th International Summer School on the Physics of Plasma-Surface Interactions, Moscow, 5-9 July 2021 : <http://plasma.mephi.ru/ru/SS2021.html>

Know Your Colleagues



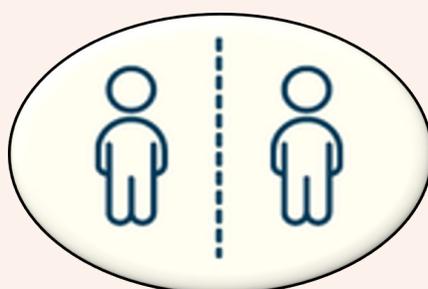
Mr. Jigar Raval joined IPR as Scientific Officer – C in May, 2008 and is currently working as Scientific Officer – E in the Inspection and Quality Section (IQS). He secured his M.Tech. degree in Manufacturing Management from BITS, Pilani. He served as Technical Responsible Officer (TRO) of Vacuum Vessel In-Wall Shield (IWS) at ITER-India from 2010 to 2014 and then at ITER France as ITER TRO for IWS from 2014 to 2019. He also received an award from the ITER DG in recognition of performance and achievements. Further, he continued his contribution to ITER Vacuum Vessel and IWS as ITER Project Associate from 2019 to 2020 and presently contributes to executing various tasks of the IQS Section. He has acquired knowledge and certificates related to Quality System and Control and has been certified as Lead Auditor for Quality Management System (ISO 9001), EMS (ISO 14001) and OHSAS 18001. He has also secured certificates in 4 areas of NDT, Six-sigma and Statistical Process Control.

Title	Page No
International Yoga day 2021	1-3
World Environmental Day	3
HPC Corner : Mechanism of Blob Formation in the Scrape-off Layer of a Tokamak Plasma	4
ITER-India Update : Gyrotron Main High Voltage Power Supply	5
Obituaries	6
International Yoga day 2021 at CPP-IPR	7
UPES "Science Series" Lecture	7
Past and upcoming Events	8
Know Your Colleague	8
Index	9

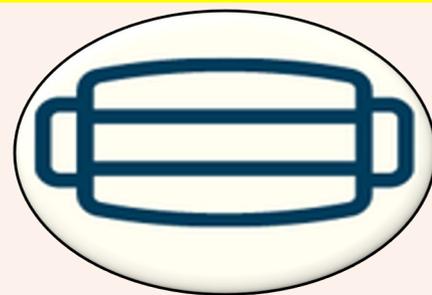
Help Fight The Covid-19 Pandemic



**Wash Your Hands frequently
With Soap**



**Ensure Social Distancing
At ALL times**



**Always WEAR a Mask
When you go outside**

- ◆ Avoid touching your eyes, nose and mouth
- ◆ If you have fever, cough and difficulty in breathing, seek medical care early
- ◆ Stay informed and follow advice given by your healthcare provider

- ◆ Inform Office immediately if you or any family member tests positive
- ◆ Follow SMS - **S**ocial Distancing : **M**ask : **S**oap/ Sanitizer
- ◆ Strictly follow social distancing while outdoors, especially at work.

**Please get yourselves vaccinated
against Covid-19**

**कृपया अपने आप को कोविड -19 के
खिलाफ टीकाकरण करवाएं**

**For your safety and for the safety of your co-workers, ensure that you always use
Arogya Setu App**

The IPR Newsletter Team

Ritesh Srivastava

Tejas Parekh

Ravi A. V. Kumar

Priyanka Patel

Dharmesh P

Mohandas K.K.

Supriya R

Suryakant Gupta

Ramasubramanian N.

Chhaya Chavda

Shravan Kumar

B. J. Saikia

Harsha Machchhar

Institute for Plasma Research
Bhat, Near Indira Bridge
Gandhinagar 382 428,
Gujarat (India)



प्लाज्मा अनुसंधान संस्थान
Institute for Plasma Research

Web : www.ipr.res.in
E-mail : newsletter@ipr.res.in
Tel : 91-79-2396 2000
Fax : 91-79-2396 2277