# Seminar

# Institute for Plasma Research

**Title :** Effect of Short Gas-puff Pulses and Biased-electrode on Transport, MHD Instabilities, Plasma-Wall Interaction and Runaway Electrons in ADITYA-U Tokamak

**Speaker:** Mr. Tanmay Macwan
Institute for Plasma Research, Gandhinagar

**Date :** 17th August 2021 (Tuesday)

**Time :** 03.30 PM

**Venue :** Online - Join the talk: https://meet.ipr.res.in/Synopsis_Tanmay
(Use alternate link if above link fails: https://meet.google.com/rbg-waxw-aki)

**Abstract :**

Despite significant advancements in tokamak research several critical challenges still remain to be solved for realizing the ultimate goal of a steady state fusion reactor. One such problem was understanding of the cold-pulse propagation. This transient plasma transport phenomena has puzzled the fusion community over two and half decades. The cold-pulse in ADITYA-U has been induced by multiple short bursts of gas puffs during the discharge. Systematic experiments in ADITYA-U have unveiled that the modifications in plasma density and its radial profile is responsible for the observed phenomena. Further, it has been identified that the Ware pinch and the ion-orbit loss mechanisms are causing the density modification due to gas/impurity injection in the peripheral plasma. These results lead to a better the understanding of particle transport in tokamaks. Furthermore, the plasma column boundary generally remain in contact with the limiter or divertor plates in tokamaks. This causes severe heat-loads on these surfaces. The remedy is to introduce a cushion of high radiation zone in between the main plasma column and limiter/divertor plates so as to avoid high head loads on these surfaces. Injection of fuel and or impurity (Ar, Ne) gas at the plasma periphery is commonly used detach the plasma of the surfaces. However, this has always led to degradation in overall plasma confinement. With injection of multiple short gas puffs in ADITYA-U tokamak, it has been shown that plasma can be detached from limiter surfaces and also the overall plasma confinement does not degrade. The confinement even improves with the application of short gas puffs along with plasma detachment in ADITYA-U.

The tokamak plasma is also prone to sudden disruptions which are completely undesirable from the point of view of machine safety. The cause are related to the uncontrolled growth of resistive tearing modes (TM). In ADITYA-U tokamak, it has been shown that the growth rates of these magnetohydrodynamic (MHD) modes can be controlled by controlling the plasma rotation. The poloidal plasma rotation is modified by inducing a radial electric field through a biased-electrode in ADITYA-U. These experimental results confirms the influence of plasma rotation of TMs in tokamaks. The induced radial electric field are also used to influence the runaway electron (RE) dynamics in a tokamak. The REs pose serious threat to plasma facing components inside the tokamak including the vacuum vessel.

In this thesis synopsis presentation the experimental details and analyses obtaining the above mentioned results will be presented.