Seminar

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Institute for Plasma Research

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Title: Study of Sawtooth Crash Induced Heat Pulse Propagation and Fast Doppler Spectroscopy Diagnostic for ADITYA-U Tokamak

Speaker: Dr. Sharvil Patel
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Date: 07th November 2024 (Thursday)

Time: 10:30 AM

Venue: Seminar Hall, IPR

Abstract

The tokamak device uses a magnetic field to confine the high-temperature plasma, aiming to generate net fusion energy output. To achieve self-sustained fusion reactions, heat loss from high-temperature plasma must be minimized, and therefore, the study of heat transport becomes important. In ADITYA plasma discharges, each sawtooth crash deposits heat beyond the inversion radius and gets rapidly transported to the plasma peripheral region. The estimated transient electron heat pulse diffusivity is found to be ten times higher than the steady-state heat diffusivity. The study finds that the significant discrepancy between transient and steady-state electron heat diffusivity is attributed to the enhanced electron heat diffusivity due to magnetic field stochastization and turbulence in the intermediate region.

Further investigation on how sawtooth crash impact the magnetic field topology and overall plasma confinement, a new fast Doppler spectroscopy (FDS) diagnostic is developed. The FDS diagnostics measures the variations in an impurity flow velocity, which can be used to infer changes in the magnetic field topology. The Photo-multiplier tube array is coupled with a 1m Czerny-Turner spectrometer, to measure transient changes in the impurity flow velocity on a time-scale of sawtooth crash time of tens of μs. Such a measurement will also provide new insight into sawtooth crash mechanism and momentum transport in tokamak plasmas. The design and implementation of the FSD diagnostics on ADITYA-U tokamak will be discussed in the presentation.