Seminar

Institute for Plasma Research

Title : Towards understanding the origins of small ELMs and rotation reversals in tokamak plasmas

Speaker: Dr. Arkaprava Bokshi
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Date : 25th July 2019 (Thursday)

Time : 03.30 PM

Venue : Committee Room 4, (New Building), IPR

Abstract:

Small edge-plasma eruptions, or Edge Localized Modes (ELMs), are periodic bursts of energy and particles which help remove impurities and provide density control, thereby critical to the steady state operation of ITER/DEMO scale tokamaks. A physical understanding of what triggers these small-ELMs has remained elusive. A new physics theory is under development which posits that (certain) small-ELM regimes may be a result of a burst in transport when the underlying linear instabilities (driven by temperature, pressure, current gradients) undergo a transition between their relatively benign (General Mode [GM]) and strongly unstable branches (Isolated Mode [IM]) under certain conditions, such as a *critical equilibrium* ExB flow-shear driven by the pedestal gradient.

In this talk, we will present our understandings from the analysis for a simple ion-temperature gradient (ITG) driven mode and build towards a more complete gyro-fluid model using the BOUT++ numerical framework. We will discuss key benchmarks and highlight important differences between the gyro-kinetic and gyro-fluid approaches.

Further efforts are underway in order to incorporate an important piece of physics into this picture: whilst the violent IM exists under special conditions, it is a poloidally symmetric mode; the relatively benign GM, which is postulated to be more readily accessible by the plasma, is however, poloidally asymmetric. A strong *intrinsic* momentum flux is associated with such asymmetric modes and may modify the previously established *extrinsic/equilibrium* critical flow shear to influence both (1) the GM-IM transition, and therefore, the accessibility to small-ELM regimes and (2) the direction of plasma rotation.