Seminar

Institute for Plasma Research

Title : Global Gyrokinetic Studies of Electromagnetic Microinstabilities in Tokamaks

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Date : 1st May 2015, Friday

Time : 03.00 PM

Venue : Committee Room 4 (New Building), IPR

Abstract:

In this thesis, electromagnetic microinstabilities in modern day hot tokamaks is investigated using multi-scale fully gyrokinetic global stability calculations. The gyrokinetic model used captures the dynamics of ions and electrons despite their disparate scales of Larmor radii. The numerical implementation is optimized to efficiently handle large size calculations. Rest of the thesis work focuses on the investigation of a particular electromagnetic multi-scale microinstability which has emerged as an important open problem in theory and experiments of hot tokamaks, namely Microtearing Modes.

Microtearing modes are electromagnetic microinstabilities, predicted to be unstable in tokamak plasmas and other magnetic confinement devices and are of interest in the context of electron-driven transport studies. These low frequency sub-ion larmor scale modes derive their free energy from the electron temperature gradient and are only unstable above a threshold plasma pressure. Earlier analytical works in slab and cylindrical plasmas investigated collisional drives as the main reason for sustaining the instability. Thus, it was predicted that in collisionless plasmas in hot tokamaks, this mode may be benign. Recently however, experimental and numerical investigations for realistic tokamak plasma parameters, particularly in the context of Spherical Tokamaks, have gathered pace and indicate that Microtearing Modes can be unstable with the electron temperature gradient as source of free energy, in the presence of finite plasma beta. Howeverwith a medium to weak collisional drive is shown to be necessary for the instability to survive.

In this work, it has been demonstrated for the first time that MTMs can be unstable in completely collisionless plasmas of large aspect ratio tokamaks. This study investigates their drives, stability properties, global 2-D structures, contribution of electron and ion species and several new scaling relationship. In this Thesis talk, these results will be presented in greater detail.