Seminar

Institute for Plasma Research

Title : Flow Effects on Visco-resistive modes in a Tokamak

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Time : 03.30 PM

Venue : Seminar Hall, IPR

Abstract:

Flow and viscosity significantly modify resistive modes in a tokamak, and we have investigated these using the CUTIE code. These studies indicate that flow can be used to improve plasma duration and quality in a tokamak, and this has motivated our investigation. In this thesis, we have begun by studying the (2,1) tearing mode and found several new results, namely, that nature of stabilisation depended on whether axial or poloidal flows were used. We also observed that the sign of shear in helical flow mattered. This symmetry breaking is also seen in the nonlinear regime where the island saturation level is found to depend on the sign of the flows. We proceeded to study the (1,1) internal kink mode using a Visco-Resistive MHD(V-RMHD) model. We have observed here that stabilisation due to axial flows in particular are affected by the viscosity regime. Symmetry breaking at higher viscosity in linear growth rates and nonlinear saturation levels as well is observed. In summary, for axial, poloidal, and most helical flow cases, there is flow induced stabilisation of the nonlinear saturation level in the high viscosity regime and destabilisation in the low viscosity regime. We have continued our studies in the two fluid regime. In the linear regime, we have studied how the growth rate as well as diamagnetic flow frequency of the modes changes due to fluid effects for a range of viscosity and resistivity values. We have also found diamagnetic drift stabilisation of the (1,1) mode in the two fluid case, that is, we have seen the growth rate of the (1,1) mode reduces with an increase in density gradient. In the nonlinear case, we investigate the evolution of the mode with imposed axial flow, poloidal and helical flows. We find the viscosity regime affects the nonlinear saturation regime.
