

Seminar

Institute for Plasma Research

Title : Experimental Study of Plasma Oscillations in IMPED

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Date : 18th January 2016 (Monday)

Time : 11.00 AM

Venue : Committee Room 4 (New Building), IPR

Abstract:

Plasma supports collective wave-like oscillations near the plasma frequency. However, the wave can lose its coherence in inhomogeneous plasma. This is due to temporal dependence of the phase difference between oscillators constituting the oscillations/wave oscillating with a frequency proportional to the square root of local plasma density (phase mixing). Phase mixing is characterized by transfer of energy from lower to higher 'k' followed by transfer of energy from wave to particle by resonant wave particle interaction. The longitudinal electric field associated with the wave may be used to accelerate electrons to high energies by exciting large amplitude wave. But plasma does not sustain waves having arbitrarily high amplitudes and beyond certain limit the wave breaks. The phenomena of wavebreaking and phase mixing of plasma oscillation/wave have applications in plasma heating and particle acceleration. For detailed experimental investigation of these phenomena a new device, Inverse Mirror Plasma Experimental Device (IMPED), has been designed and fabricated. The detailed considerations taken before designing the device, so that different aspects of the above mentioned phenomena can be comprehensively studied in a controlled manner, are described. The unique control features of IMPED that enable it to meet the prerequisite plasma condition such as quiescent, collisionless and uniform plasma are presented. The machine produces uniform plasma, $L_{\text{uniform}} \sim 120$ cm with $\delta n_{\text{noise}}/n \sim 0.2\%$ at argon filling pressure of $\sim 10^{-4}$ mbar and axial magnetic field of $B_{\text{main}} \sim 900$ G. Experimental result showing the interaction of plasma oscillation with a background ion density perturbation is presented. The power in the coherent plasma oscillations decreased significantly with increase in the amplitude of the ion density perturbation, which demonstrates phase mixing of plasma oscillation.
