Seminar

Institute for Plasma Research

Title: Experimental Study of Plasma Oscillation

Speaker: Sayak Bose, Institute for Plasma Research

Date: 29th May, 2015 (Friday)

Time: 3:30 pm

Venue: Committee Room 4 (New Building), IPR

Abstract:

Electrons in plasma undergo collective longitudinal oscillation known as plasma oscillation when the quasineutrality of the plasma is disturbed locally. It propagates due to finite temperature effects. However, the wave can lose its coherence in inhomogeneous plasma. This is due to temporal dependence of the phase difference between oscillators constituting the oscillation/wave oscillating with a frequency proportional to the square root of local plasma density (phase mixing). Phase mixing is characterized by transfer of energy form 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 phenomena can be 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, $L_{uniform}$ ~ 120 cm with $\delta n_{noise}/n \sim 0.2\%$ at argon filling pressure of ~ 10^{-4} mbar and axial magnetic field of B_{main} ~ 900G. Experimental result showing the interaction of plasma oscillation with a background ion density perturbation is presented.