

# Seminar

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## Institute for Plasma Research

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**Title:** Interplay Between Electron and Ion Plasma Waves  
**Speaker:** Dr. Thangjam Rishikanta Singh  
Pondicherry University, Puducherry  
**Date:** 17<sup>th</sup> January 2025 (Friday)  
**Time:** 03.30 PM  
**Venue:** Seminar Hall, IPR

### Abstract

We report the observation of the interplay between the first kind of high-frequency electron-dominated waves, known as electron plasma waves (EPWs), and the second kind of low-frequency ion-dominated waves, known as ion plasma waves (IPW) in a typical DC glow discharge plasma experiment. On application of a positive DC voltage to a probe immersed in plasma when the drift velocity of the electrons ( $v_d$ ) is greater than  $1.3 \times$  the electron thermal velocity ( $v_{te}$ ) gives rise to an instability resulting in the formation of DL. The DL represents nonequilibrium plasma condition that is associated with the excitation of different plasma waves and various instabilities. Under DL conditions, the anode sheath begins to extend deeper into the plasma. In this experiment, the effect of monotonic increase of  $\delta n$  ( $\approx 0.01\%$ ) on the evolution of DL has been studied. The interplay between the EPW and IPW is observed in the course of this investigation. The overall plasma response corresponding to an increase in  $\delta n$  is recorded as floating potential fluctuations (FPF) which vary with an increase of  $\delta n$ . The FPFs exhibit order-chaos-order transition with evolution of DL. Further, analysis of the fluctuations using wavelet method gives a spectrum in both the frequency and time domain simultaneously. Wavelet spectra reveal that the nonlinear evolution of FPF is a consequence of the interplay between EPW and IPW due to the trapping and detrapping of electrons in the extended anode sheath region. These results explain that the ordered oscillations correspond to dominant EPWs and the chaotic fluctuations are due to the coexistence of EPW and IPWs. This new understanding may assist in studying the complex plasma behaviour observed in laboratories as well as space plasma.

### References :

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