

Seminar

Institute for Plasma Research

Title : Excitation and Breaking of Nonlinear Plasma Wave

Speaker: Dr. Mithun Karmakar
Saha Institute of Nuclear Physics, Kolkata

Date : 06th July 2018 (Friday)

Time : 03.30 PM

Venue : Committee Room 3, (New Building), IPR

Abstract :

When a highly relativistic charged particle beam passes through plasma medium, a strong plasma wave is normally excited at the wake of that beam. I will discuss the generation mechanism of such wave excited at the wake of relativistically propagating electron beam and demonstrate the effect of external magnetic field and beam structures (Gaussian, rectangular etc.) on the wake field profiles. One of the key applications of such relativistically strong plasma wave is to produce ultra high energy charged particles for the purpose of high energy physics research. In this plasma wake field acceleration process, the highest energy that can be achieved is mainly determined by the maximum sustainable electric field in the plasma system. This limiting amplitude of the electric field is dictated by a process called plasma wave breaking. We have performed an extensive analysis to investigate the wave breaking phenomena of particularly two different high frequency nonlinear plasma modes (Langmuir wave and upper hybrid wave) with the consideration of the effect of the nonlinearities associated with inhomogeneous ion background, relativistic electron mass variation effect, ion motion etc. The onset of such wave breaking has been confirmed by the observed high density spikes in the electron fluid density obtained in investigating the space time evolution (Lagrangian fluid description) of the nonlinear relativistic plasma wave dynamics.
