Seminar

Institute for Plasma Research

Title : Proton beam driven plasma wake wave excitation and studies on phase mixing of Lower Hybrid mode

Speaker: Dr. Mithun Karmakar
Institute for Plasma Research, Gandhinagar

Date : 14th August 2019 (Wednesday)

Time : 03.30 PM

Venue : Committee Room 3, New Building, IPR

Abstract:

In this talk I will present two different problems. In the first problem I will discuss nonlinear plasma wave excitation by ultra-relativistic proton beam. We have developed a detailed theoretical model to describe stationary profiles of the wake field structures of the proton beam driven strong nonlinear plasma wave. Consideration of the plasma ion motion and the effect of an ambient magnetic field on the wake field structures have also been discussed. This investigation will have significant impact in the interpretation of the experimental observations, numerical simulation, or within the acclaimed AWAKE (Advanced Wake Field Acceleration) project at CERN devoted to achieve TeV order of particle energy by using proton drive beam.

Second problem is concerned with the description of nonlinear evolution of electrostatic lower hybrid modes in cold magnetized electron ion plasma. In our analysis the background magnetic field is assumed to be constant and the quasi-neutral plasma approximation is relaxed. The dispersion relation for such modes reads as $\omega^2 = \omega^2_{pi}\Omega^2_{ce}/(\omega^2_{pi}+\Omega^2_{ce})$, where $\Omega_{ce} = eB_0/m_e c$ is cyclotron frequency of electrons. Spatiotemporal evolution of such modes is analyzed by employing a simple perturbation technique. Our results show that an initially excited lower hybrid mode gradually loses its coherent nature due to phase mixing and eventually breaks even at an arbitrarily low amplitude.

In addition to these two problems I will briefly discuss my ongoing work on laser wake field acceleration (LWFA) process. The purpose is to understand the underlying physics in one of the complex particle injection schemes viz. ionization injection along with Direct Laser Acceleration (DLA) mechanism in the LWFA process. So far we have done some parametric studies to understand such processes and performed 2D PIC simulation (OSIRIS). The simulation results show some interesting features like bubble formation, self-injection in the wake and also betatron oscillation of the trapped particle.