Seminar

Institute for Plasma Research

Title : The Study of Localized Solutions in Laser-Plasma System

Speaker : Ms. Deepa Verma
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Date : 5th December 2016 (Monday)

Time : 11.00 AM

Venue : Committee Room 4, (New Building), IPR

Abstract:

The coupled system of laser plasma permits a wide variety of exact nonlinear localized solutions. The detailed characterization and dynamical behavior of these solutions have been studied extensively in several earlier works [1–3]. In the thesis, we have focused on three specific issues concerning these structures. (1) We have obtained analytical expressions for the cusp structures which occur when the ions undergo the wave breaking limit. Their numerical evolution shows that the structures are susceptible to Raman Forward scattering instability. (2)All previous studies were confined to a 1-D evolution of these structures. We study the evolution of these structure in 2-D and show that the erstwhile stable single peak solutions are unstable to filamentation instability. Even those structures which are unstable to 1-D forward Raman scattering instability have been shown to undergo the next phase of filamentation instability with 2-D character. (3) We have also investigated the evolution of localized solutions in which the precarious balance between ponderomotive force and the electrostatic force is disturbed significantly. We observe that the evolution exhibits interesting out of phase oscillations between field and kinetic energies. The density oscillations invariably suffer wave breaking ultimately leading to structures where radiation is trapped between density peaks. These studies have been performed both with fluid and PIC simulations and would be discussed in the talk in detail.

[1] P. K. Kaw, A. Sen, and T. Katsouleas. Nonlinear 1d laser pulse solitons in a plasma. Phys. Rev. Lett., 68:3172–3175, May 1992.
[2] Vikrant Saxena, Amita Das, Sudip Sengupta, Predhiman Kaw, and Abhijit Sen. Stability of nonlinear one-dimensional laser pulse solitons in a plasma. Physics of Plasmas, 14(7), 2007.
[3] T. Zh. Esirkepov, F. F. Kamenets, S. V. Bulanov, and N. M. Naumova. Low-frequency relativistic electromagnetic solitons in collisionless plasmas. Journal of Experimental and Theoretical Physics Letters, 68(1):36–41, 1998.