Seminar

Institute for Plasma Research

Title : Solitons and shock wave in magnetized pair-ion plasmas

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Date : 20th September 2019 (Friday)

Time : 03.30 PM

Venue : Committee Room 3, New Building, IPR

Abstract:
I shall present mainly three topics of my research work which I have performed during the post-doctoral tenure in IPR. In the first topic, I would like to discuss the solitary and shock wave in magnetized pair-ion plasmas consisting of positive and negative ions. Two fluid model is used to describe the dynamics of positive and negative ions. The Lagrangian transformation technique is used to carry out the linear and nonlinear analysis. The linear analysis shows the propagation of the fast magnetosonic waves in magnetized pair-ion plasmas. In small amplitude limit, Korteweg-de Vries Burgers' (KdVB) equation define the propagation of nonlinear magnetosonic wave. Ion–ion collisions are the source of dissipation in the system and also the origin of the Burgers' term in KdVB equation. Analytical and numerical analysis reveals that the wave exhibits the solitary wave in the absence of collisions. In the presence of collisions, the wave exhibits both oscillatory and monotonic shock structures depending on the balance between dispersion and dissipation of the system. For weak dissipation compares to dispersion, oscillatory shock structure is formed and in reverse case, nonlinear wave exhibits monotonic shock wave.

In the second topic, I would like to discuss the dissipative solitons in magnetized pair-ion plasmas. The linear analysis shows the propagation of the fast magnetosonic waves in magnetized pair-ion plasmas. In the nonlinear region, the standard reductive perturbative technique approach leads to a Korteweg-de Vries equation with a linear damping term in small amplitude limit. The dissipation in the system coming from the ion-neutral collision which is responsible for the linear damping term. The time-dependent analytic solution reveals that the soliton amplitude, energy, velocity decreases exponentially with the increase of time whereas soliton width increases exponentially with the increase of time.

I the third topic, I would like to discuss the propagation of Alfvénic wave in magnetized pair-ion plasmas. The standard reductive perturbative technique approach leads to a modified Korteweg-de Vries Burgers equation (mKdVB). The ion-ion collisional is eventually responsible for the Burgers term in the mKdVB equation. Analytical and numerical results show that the nonlinear Alfvénic wave exhibits the dissipation mediated shock in presence of collision and in absence of collision it exhibits solitary waves.