Seminar

Institute for Plasma Research

Title : Wave experiments in strongly coupled dusty plasma

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Date : 20th February 2020 (Thursday)

Time : 3.30 PM

Venue : Seminar Hall, IPR

Abstract :

In a dusty plasma, dust particles floating in the sea of electrons and ions can be weakly or strongly coupled due to their heavy mass and large charge. It may lead to the formation of gaseous or fluid or even crystalline like state depending on the strength of interaction [1,2]. Various collective phenomena are observed in these states of dusty plasma such as evolution of low frequency waves known as "dust acoustic waves", formation of voids, vortices, Mach cones etc. Dust acoustic waves get transformed into dust acoustic solitons in the nonlinear regime. Soliton is a robust and stable localized nonlinear structure which arises due to the delicate balance between nonlinearity and dispersion of the medium. Interaction of solitons is an interesting topic of study in normal fluid and plasma as reported by many authors [3-6]. In one dimension (1D), there can be overtaking collision between two co-propagating solitons and head-on collision between two counter-propagating solitons, whereas in two dimension (2D), oblique collisions occur between solitons propagating at an angle to each other. We have investigated the characteristics of dust acoustic solitons and their 1D and 2D interaction with each other in a strongly coupled unmagnetized dusty plasma. A radio frequency discharge dusty plasma is produced inside a cylindrical glass chamber at a pressure of 10^{-2} - 10^{-3} mbar by adding micron silica dust into the plasma [7]. Low frequency dust acoustic waves are excited and wave motions are recorded using a high speed camera with laser light illumination. DAW dispersion relations are obtained at various discharge conditions. Single as well as multiple solitons are excited in strongly coupled dust medium by simple excitation techniques and their characteristics have been studied. We have also observed that the incident solitons survive both 1D and 2D collisions [7,8]. A small time delay is observed after collision in the head on interaction and oblique collision between two solitons give rise to a resonance state. Experimental results are compared with relevant theory.

References:

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