Seminar

Institute for Plasma Research

Title : Self-organized dust Rotation in an unmagnetized DC Glow Discharge

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Date : 11th December 2015 (Friday)

Time : 03.30 PM

Venue : Seminar Hall, IPR

Abstract:

Dusty plasmas are low temperature plasmas comprising of micron or sub-micron sized particles in addition to electrons, ions and neutrals. The dust particles inside plasma acquire large negative charges due to the higher mobility of electrons than ions, which enables them to interact with their neighbours very strongly and result into many new and interesting phenomena. Self-organized rotation of mono-dispersed dust particles is one such interesting phenomenon that has been investigated in parallel plate dc glow discharge and will be presented. Self–organized poloidally rotating micro-particles (in toroidally symmetric stuctures) are observed at high pressures (p > 100 Pa) with a concentric metallic ring placed above the cathode surface. Especially designed Langmuir probe measurements reveal that a strong radial density gradient in the background plasma exists above the metallic ring where the poloidally rotating structures are confined. This is further confirmed by experimentally introducing an additional density gradient in the system which leads to generation of an additional poloidally rotating structure, strengthening the importance of role played by density gradient in the formation of rotating dust clouds. Analysis using Navier-Stoke's equation confirms a radial gradient in the ion drag force arising due to the density gradient as the principal cause of dust rotation than all other possible effects (such as dust charge gradient). Variation in discharge parameters leads to many other interesting observations such as the dust particle velocity increases considerably with an increase in the discharge current and neutral gas pressure. The increase in dust velocity with an increase in neutral pressure is contrary to the general trend of decrease in dust velocity with an increase in neutral friction. Additionally, a transition from the filled disk-like to ring-like poloidal structures with void (dust-free region) at the centre is observed and will be presented.