

Effect of hot electrons on the dust charge and particle levitation in a strongly coupled dusty plasma

Abstract

A dusty plasma (or a complex plasma) is a system consisting of micron-sized particles embedded in the usual two-component electron-ion plasma. The massive dust particles in the plasma environment become negatively charged due to receiving a higher flux of electrons as compared to ions. One of the spectacular phenomena that can occur in a dusty plasma is the formation of an ordered arrangement of the dust component with characteristic features of a crystalline structure. Dusty plasma crystals provide an excellent experimental platform for investigating a host of fundamental physics problems.

Emissive probe has been widely used as one of the diagnostic tools to measure the plasma potential and hence the electric field in the plasma. In absence of dust particles, one can estimate the dust charge by estimating the electric field in the sheath region. In presence of dust, the amount of charge that resides on the dust surface modifies due to the electrons emit from the filament of an emissive probe. Moreover, the electrons may also alter the sheath electric field around the dust particles as well as the levitated electric field. In this project we will study the effect of electron emission on the dust charge and particle levitation. The experiments will be carried out in Dusty Plasma Experimental (DPEX-II) device. A DC glow discharge Argon plasma will be produced and the micron sized dust particles will be introduced in the plasma. These particles will be confined in an electrostatic potential well and form an ordered structure. The particles will be illuminated by a laser source and Mie scattered light from the particles will be recorded by couple of cameras in the form of consecutive images. A hot filament will be used to alter the charge and sheath electric field and the dynamics of the dust particles will be investigated over a range of discharge parameters and filament current.

Academic Project Requirements:

1) Required No. of student(s) for academic project: 1

2) Name of course with branch/discipline: M.Sc. Physics

3) Academic Project duration:

(a) Total academic project duration: 12 Weeks

(b) Student's presence at IPR for academic project work: 5 Full working Days per week

Email to: pintu@ipr.res.in[Guide's e-mail address] and project_phy@ipr.res.in [Academic Project Coordinator's e-mail address]

Phone Number: 079 -8141680353 [Guide's phone number]