

# Seminar

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## Institute for Plasma Research

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**Title :** Yukawa Liquids Under External Forcing: A Molecular Dynamics Study

**Speaker :** Mr. Harish Charan

Institute for Plasma Research, Gandhinagar

**Date :** 13th June 2017 (Tuesday)

**Time :** 03.30 PM

**Venue :** Seminar Hall, IPR

### **Abstract :**

A collection of electrons and ions interact via bare Coulomb potential. At sufficiently large number densities, due to finite temperature of electrons and ions, this bare interaction gets shielded due to other charges, leading to a shielded Coulomb interaction or a Yukawa interaction. For plasma particles, the inter-particle potential energy per particle is much smaller than its kinetic energy. This medium is said to be weakly coupled or weakly correlated. A novel medium is formed if large, massive, micron-size, conducting or dielectric spherical grains are introduced into this above said plasma medium. Due to their size, these grains tend to acquire a large, mean negative charge. The grain-grain interaction is then also shielded by the background plasma, however, this time around, inter-grain potential energy can be much larger than the average kinetic energy per grain. Thus, the grain medium is a prototype for strongly coupled or correlated systems such as Yukawa liquids. Other examples are ultra-cold plasma, charged colloids and several astrophysical objects.

Using non-equilibrium molecular dynamics simulations, I subject a 2D bed of strongly coupled grain medium to external forcing such as external gravity, temperature gradient and subsonic and supersonic flow heads. Several novel structure formations such as solid-like Yukawa liquids, Rayleigh-Benard convection cells, von Karman vortices and super-sonic Bow shocks have been found along with new scaling laws. In this talk, various physics findings along with simulation details will be discussed in detail.

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