Seminar

Institute for Plasma Research

Title : Strongly coupled 2D Yukawa liquids under external forcing: A molecular dynamics study

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Date : 23rd December 2016 (Friday)

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 their 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 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 Yukawa liquid. 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 flow head. 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 thesis talk, various physics findings along with simulation details will be discussed.