

Seminar

Institute for Plasma Research

Title: Turbulent vortex flow in dusty plasma

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Date: 16th July 2024 (Tuesday)

Time: 03:00 PM

Venue: Seminar Hall, IPR

Abstract

Table-top dusty plasma experiments are an excellent avenue to explore various collective phenomena at a granular resolution. In experiments, highly charged dust clouds host waves, instabilities, complex flows, turbulence, phase transitions, as few reported observations. These collective phenomena usually result from the interplay of physical mechanisms involving electrons, ions, dusts, and neutral gas and cover domains of fluid dynamics and condensed matter physics.

At Shivalik Plasma laboratory at IIT Jammu, we have conducted dusty plasma experiments in a DC discharge setup. A three-dimensional dusty plasma forms in the diffused region of plasma and host variety of self-excited collective phenomena at different discharge conditions.

This presentation reports on the observation of Kolmogorov turbulence in a three-dimensional dust cloud. Under different discharge conditions and hence different plasma backgrounds, self-excited and self-consistent dust vortex flows formed locally at multiple locations in the cloud. In all such vortex flows, we observe the features of fully developed turbulence with a characteristic $-5/3$ scaling in both the space (wave vector) and time (frequency) domains. The results are supported by $2/3$ scaling in the second-order structure factor. We also obtained for the probability distribution function of velocity gradients a deviation from Gaussian distribution at tails in line to turbulent intermittent flows. It is interesting to observe turbulent mixing with typical hydrodynamic scales at very low Reynold's number regime of the order of few tens.
