Seminar

Institute for Plasma Research

Title : Study of turbulent and shear flows in viscous and viscoelastic fluids

Speaker: Dr. Akanksha Gupta
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Date : 13th August 2021 (Friday)

Time : 03.30 PM

Venue : Online - Join the talk: https://meet.ipr.res.in/Dr.AkankshaGupta_PDFTalk

Abstract :

Turbulence is a ubiquitous phenomenon and is not fully understood yet. In the real world, both in nature and man-made laboratory, all fluids exist in three-dimensions. There are many fluids in astrophysical and geophysical systems, where length scale in one direction is much larger than other two, hence, treated as ideal 2D or quasi-2D system. One can also find 2D systems, when rotation and strong magnetic field are present. Two and three-dimensional fluids have significantly different characteristics. Therefore, understanding of 2D fluid turbulence is important for many systems for example, Earth, and planetary atmosphere.

The present study is divided into two parts. In the first part, the energy transfer in the Fourier modes of two-dimensional fully developed turbulent flow has been studied via high resolution Direct Numerical Simulation (DNS). To simulate turbulent flows in fluids, a pseudo spectral method based code TARANG has been used. We analyze the energy spectrum and fluxes (energy and enstrophy). It is observed that kinetic energy is transferred from the forced scale to larger scale, however, in contrast, enstrophy goes from the forced scale to smaller scales called inverse and forward cascade respectively [1]. In the second part, various important properties of shear flow dynamics in viscoelastic fluids, e.g. dusty plasma system using a generalised compressible hydrodynamic model and molecular dyanmics simulation will also be presented, for example, nonlinear compressible vortex flow dynamics of shear flow in the presence of variable density, pressure, and electrostatic potential, pattern formation, vortex merger, and propagation of rotional waves [2,3], to mention a few.

References:

[1] Gupta et al. Phys. Rev. E 100, 053101 (2019).
[2] Gupta and Ganesh, Phys. Plasmas Letter, 27, 050701 (2020). (Editor's Pick as cover page)
[3] Gupta and Ganesh, Phys. Plasmas, 25, 013705 (2018). (Editor's Pick)