ICTS | INTERNATIONAL CENTRE for THEORETICAL SCIENCES

TATA INSTITUTE OF FUNDAMENTAL RESEARCH

ICTS Fluid Dynamics Seminar

Title : Motion of anisotropic particles in turbulence

Speaker : Prateek Anand (ICTS-TIFR, Bengaluru)

Date : Tuesday, 14 January 2025

Time : 5:30 PM (IST)

Abstract : I examine the dynamics of sub-Kolmogorov anisotropic particles sedimenting through turbulence. Such systems are commonly found in nature and industry, for instance, ice crystals in Cirrus clouds. I perform three-dimensional direct numerical simulations (DNS) of such crystals, modelled as spheroids, settling through a homogeneous isotropic turbulent flow field, including the effects of gravity on both the particle translational and rotational degrees of freedom, for a wide range of spheroid aspect ratios and Stokes numbers. For the majority of the cases, orientation distributions peak at the broadside-on (to gravity) orientation, and depart significantly from Gaussianity. Most of the DNS results compare well against theoretical predictions in the inertialess rapid-settling limit, with the deviation from theory occuring for Stokes numbers of order unity due to a spatially inhomogeneous particle concentration field. The spatial inhomogeneity of the concentration field is characterized via a correlation dimension D2 allowing an estimate of clustering effects down to the Kolmogorov scale. D2 is found to be shape sensitive, with the degree of clustering being more for extreme shapes. I also show that extreme-shaped spheroids approach each other faster for St <= 0.4 as compared to the spherical particles. These results can be used to model collision kernels for settling anisotropic particles.

Venue : Online
Zoom Link: https://icts-res-in.zoom.us/j/98983510530?pwd=hkwZkx2d8oyDwTHa3OiUkSwCvabWqC.1
Meeting ID: 989 8351 0530
Passcode: 151516