ICTS Skype Seminar

Title : Inertial particles in non-homogeneous elastic turbulence

Speaker : Himani Garg, Universite de Lille, France

Date : Wednesday, January 16, 2019

Time : 02:45 PM

Venue : Amal Raychaudhuri Meeting Room, ICTS Campus, Bangalore

Abstract : Inertial particle dynamics have been comprehensively studied both in laminar and turbulent flows in Newtonian fluids. More recently the focus has widened on high Reynolds non-Newtonian, and in particular viscoelastic flows. The present study aims at investigating the yet unexplored situation of inertial particle dispersion in viscoelastic fluids in elastic turbulence conditions, i.e., in flow conditions of vanishing Reynolds and high Weissenberg numbers. We carry out extensive direct numerical simulations of the periodic Kolmogorov mean shear flow of two-dimensional dilute polymer solution described by Oldroyd-B model seeded with passively transported heavy inertial particles. We focus on the relationship between underlying flow structure and the particle concentration as a function of particle inertia. Our analysis interestingly reveals that particles are preferentially clustered in the regions of in- stantaneously maximally stretched polymers. Such a phenomenon depends on the interplay between the particle inertia and the single time scale characterizing the elastic turbulence smooth flow, which is parametrized by the Stokes number. We find that the particles accumulate in small-scale fractal clusters and at the same time undergo turbophoretic segregation along the non-homogeneity direction of the flow. Our findings reveal that at larger scales the particle distribution is strongly related to the mean turbulent-like structures of the flow. As an effect of turbophoresis, average density profiles peaks in the region of minima of the turbulent eddy diffusivity. We discuss quantitative explanation for the observed uneven mean particle distribution due to turbophoresis for particles with $St \leq 1$.