Chirality of particles doesn't matter in strong turbulence

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Turbulent inertial particle-laden flows are ubiquitous in natural and engineering environments. Although the interest in particle-laden turbulence has increased in the last decade, most of the previous studies have either focussed on particles with vanishing inertia, which behave as passive tracers, or on inertial particles with highly symmetric shapes, especially spheres or ellipsoids.

In this study we employed inertial finite-size chiral particles under the effect of gravity in a tri-periodic domain with homogenous isotropic turbulence. The dispersed phase is not only transported by the carrier flow, but it is responsible of exerting forces on the fluid (i.e. two-way coupling). Furthermore, particles collision are also taken into account.

Chirality is a property of anisotropy, for which an object is distinguishable from its mirror image and chiral particles break spatial reflection symmetry, coupling translational and rotational degrees of freedom. This feature is evident from the vorticity statistics, highlighting a Froude number effect. Indeed, we observe a deviation of the mean vorticity z-component pdf from zero in the low Re_λ regime. Moreover, the shifting is positive or negative depending on the chirality of the particles. The effects of Reynolds number, density ratio and volume fraction loading will be presented at the conference.

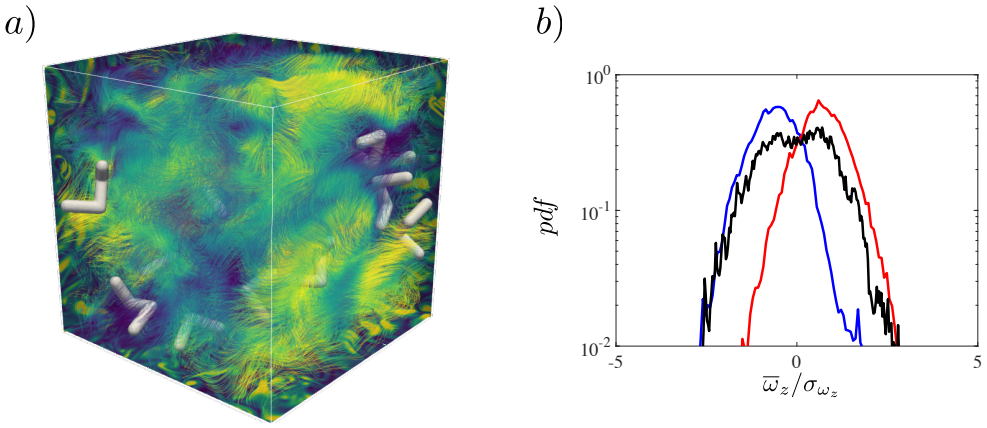

Figure 1: (a) Exemplary 3D snapshot of the system showing chiral finite size particles in Homogenous Isotropic Turbulence for $Re_\lambda = 70$, $\phi = 1\%$ and $\rho_p/\rho_f = 7$. (b) pdf of the vorticity z-component normalised by its standard deviation for $Re_\lambda = 30$, $\phi = 1\%$ and $\rho_p/\rho_f = 10$ in case of spheres (black line), left-handed chiral particles (blue line) and right-handed chiral particles (red line).

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