Spatial distribution and relative dispersion of heavy particles in turbulent flows

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Statistical and dynamical properties of heavy particles suspended in an incompressible isotropic and homogeneous turbulent flow are discussed using datasets from of high resolution direct numerical simulations.

We first focus on the stationary spatial inhomogeneous distribution of heavy particles at different ranges of scales. At very small spatial scales, smaller or comparable to the Kolmogorov scale of the advecting flow η, it is shown that particles form fractal clusters with properties independent of the Reynolds number. Clustering is there optimal when the particle response time is of the order of the Kolmogorov time scale τ_η. At larger scales, in the inertial range, the particle distribution is no longer scale-invariant. It is however shown that deviations from uniformity depend on a rescaled contraction rate, which is different from the local Stokes number given by dimensional analysis.

We then present preliminary results about heavy particle relative dispersion. The role of inertia in the different time regimes occurring during the particle separation process is highlighted. Long-time statistics are consistent with the Richardson regime characteristic of fluid particle pairs, while early and intermediate time regimes exhibit noticeable deviations.