

PhD PROPOSAL

Particle dispersion in inhomogeneous turbulent flows.

A spectacular property of turbulent flows is their ability to mix components in a very efficient way. The theoretical study of transport and mixing by fluids is expressed naturally by studying the statistical properties of fluid particle trajectories that actually transport the components to mix (the Lagrangian approach, Figure 1). The Lagrangian properties of homogeneous and isotropic turbulence are now relatively well known thanks to investigations of the last 15 years. The case of inhomogeneous flows is much less studied, especially concerning experiments. However most natural or industrial flows are neither homogeneous nor isotropic due to the presence of walls and thus of boundary layers (pipe flows, atmospheric boundary layer...) and/or due to confinement (chemical reactors, combustion chambers).

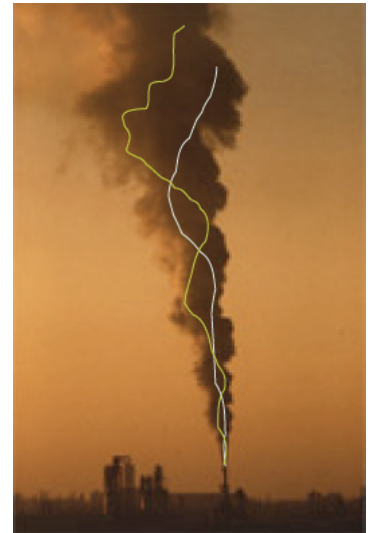


Figure 1 : dispersion of two particles in a turbulent jet.

We propose here to track particles in a very large volume of a confined flow at high Reynolds numbers to obtain trajectories larger than the flow integral scale.

This will allow to characterize the influence of large scale shear and inhomogeneity on the dynamics of small tracers of the flow motions.

The PhD student will study experimentally the collective dynamics of particles freely transported in a turbulent von Karman flow of water at high Reynolds number. Using several ultra fast cameras allowing to track a cloud of particles, the PhD will focus on one particle dispersion (Taylor dispersion) and two particles dispersion (pair dispersion). These measurements will allow not only to get better insight in the influence of the large flow scale inhomogeneity onto particles trajectories, but also to test stochastic models of particle transport developed for inhomogeneous turbulence.

The Phd will be done under direct supervision of Romain Volk at laboratory of physics of Ecole Normale Supérieure de Lyon.

This project is funded by French Agence Nationale de la Recherche. The PhD can start with flexible dates in 2014. Internship during spring-summer 2014 is possible.