Experimental characterization of Fluctuation Induced Force in turbulence

Fluctuation induced forces (FIFs) arise from the modification of a fluctuating field by the boundary condition imposed by an object. The most well known FIF is the Casimir effect where two electrical conductive plates in vacuum experience an attractive force due to the selection of fluctuating modes of the electromagnetic field in between the plates. This phenomenon has also been observed in various other fields of physics : polymer science, hydrodynamic, granular material, etc.

If such FIF has been predicted numerically in 3D turbulence, it has never been measured experimentally. The goal of this internship is to investigate for the first time FIF in 3D turbulence by measuring the attractive force between two facing plates immersed in a fully turbulent flow and relates this force to the modification of the flow in between the plates. This project is a first step toward the modelling of the influence of hydrodynamics interactions on particle aggregation in turbulence. The experiment will be done in the "cube" setup which has been extensively used to investigate Lagrangian turbulence. The forces applied on each plates will be measured thanks to force sensors. These force measurements will be synchronised with Particle Image Velocimetry (PIV) measurements to relate them to the flow perturbation. During the internship both the influence of the plate size and the turbulence intensity will be investigated.

The internship will take place at IRPHE, Marseille, and last at least 8 weeks. The recruited intern will be in charge of running the experiments, acquiring and analysing the experimental data and will participate to the modelling of the phenomenon.

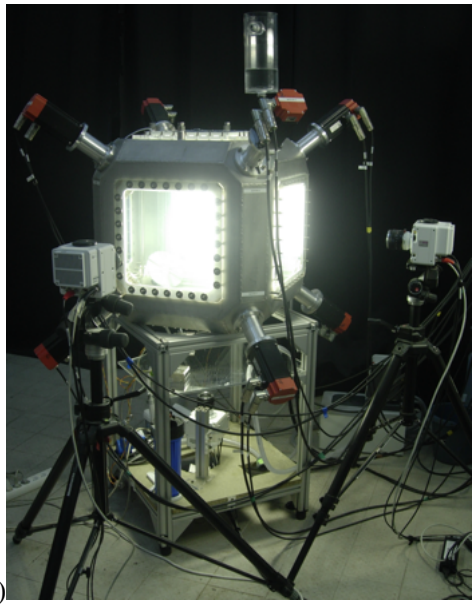
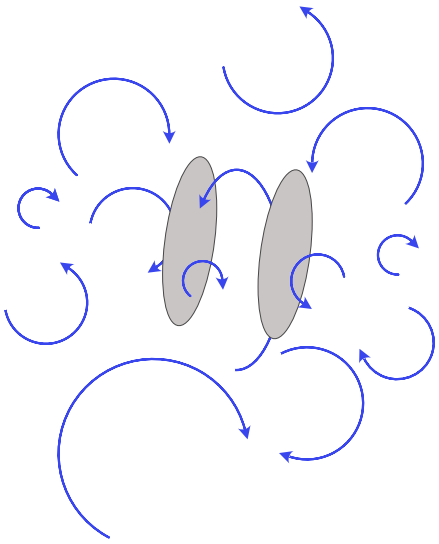
a)  b) 

FIGURE 1 – a) Image of the "cube" facility. b) Sketch of the FIF principles : only coherent structures smaller than the gap between the plate or anisotropic strucutres can survive in between the plate. The difference of fluctuation inside and outside the gap is at the origin of the Fluctuation Induced Force.

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