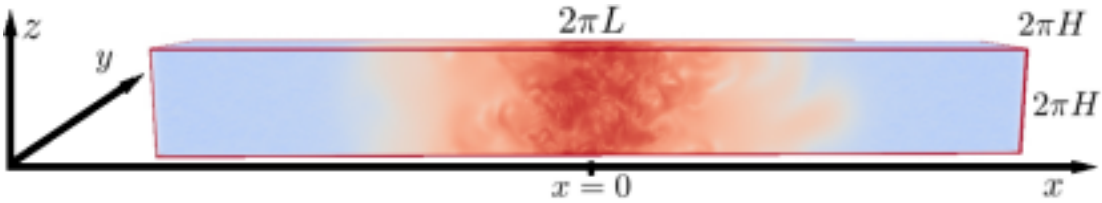
Laboratoire de Mécanique des Fluides de Lille
Kampé de Fériet



Stage de Master 2

HOW NON-HOMOGENEITY AND THE TURBULENCE CASCADE INTERFEER WITH EACH OTHER

The vast majority of flows in nature, engineering and the environment are turbulent and non-homogeneous in physical space. The non-linearity at the heart of the evolution of turbulent flows implies (i) a turbulent transport of turbulent energy through physical space and (ii) a transfer of energy between turbulent eddies of different sizes, the essential process of the turbulence cascade which leads to turbulence dissipation.

Research over the past couple of years is showing that these two processes limit each other. A new theory has emerged which makes clear and simple predictions about turbulence cascades in non-homogeneous turbulence and a new simple and fundamental canonical turbulent flow has been proposed for the study of such cascades. The aims of the project are to use this new canonical flow to (i) investigate the hypotheses of the new theory and (ii) explore whether the new theory can explain the cascade's effect of slowing down the spread of the turbulence in this new canonical flow.

The stage will last for 6 months. The student will be co-supervised by A. Alexakis (ENS, Paris) and C. Vassilicos (LMFL, Lille) and will use existing codes for the simulation of the turbulent flow and for the data analysis. The student will also need to spend some time on various theoretical aspects of turbulence and will contribute to the interpretation of the analysis of the simulation data.

The student will have a strong interest in physics and/or fluid dynamics.

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References: Two of the three papers on which this stage is based have been submitted for publication in the summer of 2023 but are not yet published and can be obtained by emailing the contacts above. The third paper is "Scalings of scale-by-scale turbulence energy in non-homogeneous turbulence" J. Fluid Mech. vol 946, A41, (2022).