LadHyX Seminar – October 14th, 10:45 am

Marine Aulnette
(LadHyX, PMMH)

Vortices across length scales : from oceanic vortices to particles in a microfluidic vortex

Vortical flows and particle-laden flows are ubiquitous in nature, and their interplay has gained renewed attention in the context of environmental microplastic pollution. The transport of microplastics in the ocean is governed by a broad range of hydrodynamic processes, from turbulent flows to fine-scale oceanic structures. In the first part of this seminar, I will focus on vertical motions in fine-scale oceanic structures, such as vortices. These motions lie beyond the classical two-dimensional geostrophic description and give rise to ageostrophic vertical velocities. Measuring and understanding these fine-scale vertical motions remains a major open question in oceanography, as they are thought to play an important role in ocean mixing and transport processes. In the second part, I will turn to the transport of fibers in a microfluidic vortex. Fibers constitute a significant fraction of microplastic debris found in the ocean, and their elongated shape introduces an additional orientational degree of freedom. This becomes particularly important in complex flows where strain and rotation coexist, such as turbulence. We investigate these orientation dynamics using a controlled microfluidic analogue of a stretched vortex tube.