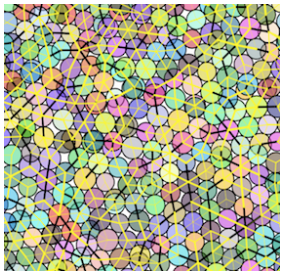

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An introduction to hydrodynamic turbulence

jeudi 9 juin 2022 14:00 (1h 30m)

Lecture 1 by Benjamin Favier: Basics on hydrodynamic turbulence

Lecture 2 by Pierre-Philippe Cortet: Turbulence in rotating fluids

Lecture 3 by Basile Gallet: Turbulent convection

Hydrodynamic turbulence ispart of our daily lives but remains a fundamental research challenge in fluid mechanics, with applications ranging from turbulent transfer and mixing in industrial flows to improved predictions of extreme weather events in a warming climate.

In the first lecture, we will discuss the phenomenology of turbulence in three dimensions, characteristic of most fluid flows surrounding us, before addressing the two-dimensional case as a first model of large-scale geophysical flows.

The second and the third lectureswill address turbulence subject to two important physical ingredients of natural flows: global rotation and thermal effects.

Global rotation is one of the key ingredients of turbulent flows encountered in oceanic, atmospheric and astrophysical contexts. An important consequence of global rotation is the emergence of a specific class of waves, resulting from the
action of the Coriolis force and propagating in the volume of the fluid. These waves and the classical vortex structures of fluid dynamics coexist and interact, which results in a strongly modified turbulence phenomenology. We will introduce this scenario and illustrate it with laboratory observations.

Thermal convection refers to flows induced by unstable temperature gradients within a fluid: cool fluid is heavier than warm fluid and spontaneously “falls” under the latter. Turbulent convective flows arise in industrial, geophysical and astrophysical contexts, where the nature of the asymptotic turbulent convection regime remains a delicate and highlydebated topic. Motivated by geophysical and astrophysical flows, we will review the various theoretical predictions and their recent validation in laboratory experiments.

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