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Università di Roma Tor Vergata
Dipartimento di Fisica

Seminar

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"Energy cascades and coherent structures in geophysical turbulence: a statistical mechanics approach"

Abstract

Like all turbulent flows, geophysical flows, such as the atmosphere and the ocean of the Earth, exhibit continuous energy spectra associated with coexisting motions over a broad range of length scales. Although the velocity field is subjected to strong fluctuations, long-lived coherent structures also appear at the large scales. To understand how these motions are maintained, it is necessary to understand in an idealized framework how the energy is transferred across scales in turbulent fluids subjected to rotation and density stratification. These two ingredients break isotropy, and the standard 3D Kolmogorov cascade scenario is no longer valid. They also lead to balanced motions at large scales, which are reminiscent of 2D turbulence.

In this talk, I will use arguments from statistical mechanics to discuss the energy cascade phenomenologies in rotating and stratified turbulence, and explain how phase relations can appear, leading to the emergence of coherent structures at the large scales.

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