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Turbulence at the Kolmogorov scale

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If you stir strongly enough a viscous flow, it becomes turbulent and displays vortices and coherent structures of various sizes. The typical scale for energy dissipation is called the Kolmogorov scale η and marks the transition between the power law behavior and a steep exponential decay in the wavenumber range. Therefore, scales smaller than η contains a negligible fraction of the kinetic energy. Because of that, it is often thought that scales below η are irrelevant and that "nothing interesting is happening below η". For a long time, it was for example thought that a direct numerical simulation of a viscous fluid is "well resolved"if its minimal grid spacing is η. Recent theoretical and experimental progresses however suggest that many interesting phenomena do happen below η and this may impact the validity of Navier-Stokes equations (NSE) as model for the dynamics of industrial, geophysical or astrophysical fluids. This talk discusses some of these phenomena using both numerical simulations and a dedicated large turbulent experiment.

Presenter: DUBRULLE, Bérengère