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Large scale structures and energy transfer in hydrodynamic turbulence PABLO MININNI, ALEXANDROS ALEXAKIS, ANNICK POUQUET, NCAR — With the help of direct numerical simulations, we investigate the transfer of energy and triadic interactions in fully developed forced three-dimensional hydrodynamic turbulence. The assumption of locality of transfer among the different scales is one of the building blocks of Kolmogorov (1941) theory of turbulence. We use simulations on a grid of 1024^3 points of a flow forced with a Taylor-Green vortex. Reynolds numbers of $R = 790$ (based on the Taylor lengthscale) are reached. In the steady state, the flow displays a well defined large scale pattern superimposed with turbulent fluctuations at small scales. We find that nonlinear triadic interactions are dominated by their non-local components, involving widely separated scales, even though the nonlinear transfer itself is local and the scaling for the energy spectrum is close to the classical Kolmogorov law. These non-local interactions with large scales represent 20% of the total energy flux. The link between these findings and the intermittency of the small scales, and their consequences for modeling of turbulent flows are also briefly discussed.

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