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Direct observation of energy cascade in three-dimensional turbulence HAITAO XU, FABIO DI LORENZO, Max Planck Institute for Dynamics and Organization (MPIDS), Goettingen, Germany, ALAIN PUMIR, Max Planck Institute for Dynamics and Organization (MPIDS), Goettingen, Germany, and ENS-Lyon, Lyon, France, EBERHARD BODENSCHATZ, Max Planck Institute for Dynamics and Organization (MPIDS), Goettingen, Germany — In three-dimensional turbulence, energy is supplied at large scales and cascaded down to smaller and smaller scales. The energy flux can be measured by, e.g., the velocity structure functions. On the other hand, the temporal process of the energy cascade, such as how fast it takes for energy at the forcing scales to transfer down to the dissipative scales, has received relatively little attention. Using novel laboratory turbulent flows and measurement techniques, we experimentally studied the response of turbulence in the inertial and dissipative scales to a sudden excess of energy in the forcing scales. Our measurements give us direct access to the energy cascade process. We also compare our observation with results from direct numerical simulations.

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