Abstract Submitted
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Grid Turbulence in PEO solutions[1] PETER MONKEWITZ, RICHARD VONLANTHEN, Swiss Federal Institute of Technology Lausanne (EPFL) — Grid turbulence in dilute PEO solutions is studied experimentally in a small, closed loop hydraulic tunnel. To attain higher Reynolds numbers based on the Taylor microscale of the order of 100 and an inertial range of about one decade, a novel passive grid with tethered spheres has been developed. By carefully studying the evolution of turbulence spectra as function of the age of the PEO solution, i.e. of the degradation of polymer molecules, it has been possible to clearly identify a time-dependent "Lumley" wave number κ_L where the fluid behavior switches abruptly from Newtonian to visco-elastic. This switch is characterized by a rather sharp transition from the Kolmogorov $\kappa^{-5/3}$ slope of the energy spectrum to a κ^{-3} slope. Dimensional analysis shows that this corresponds to a switch from constant down-scale energy flux to a self-regulated constant eddy rate of strain. A simple model is proposed for the time-dependence of the Lumley scale κ_L.

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