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Non-linear amplification in hydrodynamic turbulence[1] KARTIK IYER, KATEPALLI SREENIVASAN, New York Univ NYU, P.K YEUNG, Georgia Institute of Technology — Using Direct Numerical Simulations performed on periodic cubes of various sizes, the largest one being 8192^3, we examine the nonlinear advection term in the Navier-Stokes equations in fully developed turbulence. Flow regions with depleted nonlinearity are not found to be correlated with low dissipation, in contrast to theoretical claims (Moffat & Tsinober, Annu. Rev. Fluid Mech. **24** 281-312 (1992)). With increasing Reynolds number (R_λ), the Navier-Stokes dynamics amplifies the solenoidal (divergence free) part of the nonlinear term, in contrast to the nonlinear suppression observed in past studies (Kraichnan & Panda, Phys. Fluids **31** 2395-2397 (1988); Shtilman, Phys. Fluids A **4** 197-199 (1992)), at low R_λ. With increasing R_λ, the nonlinear amplification makes the vortex stretching mechanism more intermittent, with the vortex stretching spectrum displaying a scaling anomaly similar to other small-scale quantities commonly examined in turbulence. At higher R_λ, the vortex tubes are passively advected for much of the time, with the intense stretching of the vortex tubes occurring rarely, but accounting for much of the forward cascade dynamics.

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