Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Extreme events and small-scale structure in computational turbulence[1] X.M. ZHAI, P.K. YEUNG, Georgia Tech, K.R. SREENIVASAN, New York Univ — Detailed analyses have been made of data from a direct numerical simulation of turbulence on a periodic domain with 8192^3 grid points designed to improve our understanding of small-scale structure and intermittency. At the Reynolds number of this simulation (1300 based on the Taylor scale) extreme events of dissipation and enstrophy as large as 10^5 times the mean value are observed. These events are shown to possess a form that is different from similar events at low Reynolds numbers. Extreme vorticity appears to be "chunky" in character, in contrast to elongated vortex tubes at moderately large amplitudes commonly reported in the literature. We track the temporal evolution of these extreme events and find that they are generally short-lived, which suggests frequent sampling on-the-fly is useful. Extreme magnitudes of energy dissipation rate and enstrophy are essentially coincident in space and remain so during their evolution. Numerical tests show sensitivity to small-scale resolution and sampling but not machine precision. The connections expected between indicators of fine-scale intermittency such as acceleration statistics and the anomalous scaling of high-order velocity structure functions are also investigated.

[1]Supported by NSF Grant ACI-1036170 (Track 1 Petascale Resource Allocations Program)

PUI-KUEN YEUNG
Georgia Institute of Technology

Date submitted: 30 Jul 2015 Electronic form version 1.4