Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Resolution effects and the structure of extreme velocity gradients in high Reynolds number turbulence[1] DHAWAL BUARIA, Max Planck Institute for Dynamics and Self-Organization, ALAIN PUMIR, ENS de Lyon, EBERHARD BODENSCHATZ, Max Planck Institute for Dynamics and Self-Organization, P. K. YEUNG, Georgia Tech, INTERNATIONAL COLLABORATION FOR TURBULENCE RESEARCH COLLABORATION — It is well known that turbulent flows develop strong velocity gradients, characterized as small-scale intermittency, with these gradients becoming more and more intense with increasing Reynolds number. These extreme gradients play a critical role in applications such as turbulent combustion, cloud physics, but their formation remains to be understood in detail. Using high-resolution direct numerical simulations (DNS) of isotropic turbulence, up to Taylor scale Reynolds number of 1300, we analyze the structure of the velocity gradient tensor, with particular emphasis on the extreme events. We first revisit the effect of small-scale resolution, measured in DNS by $k_{max}\eta$, where k_{max} is maximum wavenumber resolved and η is the Kolmogorov length scale. We find that $k_{max}\eta \geq 3$ is required to adequately resolve the structure in the eigenframe of the strain tensor, with lower resolution possibly resulting in spurious observations for the most extreme events. The alignment of vorticity with the intermediate eigenvector of strain is found to be much stronger when conditioned on large gradients, than the overall unconditioned alignment, possibly related to the weakening of the self-amplification of vortex structures when they become more intense.

[1]Supported by EuHIT and NSF Grant ACI-1640771

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Date submitted: 29 Jul 2017 Electronic form version 1.4