Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Velocity statistics distinguish quantum from classical turbulence
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We present experimental studies of the velocity statistics of decaying quantum turbulence in superfluid ^{4}He. By analyzing the trajectories of solid hydrogen tracers, we observe velocity distributions with strongly non-Gaussian $1/v^3$ power-law tails. These statistics differ from the near-Gaussian distributions observed in homogenous and isotropic classical turbulence. We attribute the distinction with classical turbulence to quantized vortex dynamics and reconnection, which produces high, atypical velocities. We identify and analyze the dynamics of approximately 40,000 individual reconnection events and show by simple scaling arguments that they produce the observed power-law velocity tails. The potential implications for multifractal models of classical turbulence are discussed.

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Date submitted: 05 Aug 2008 Electronic form version 1.4