Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

The number of Eulerian points required to describe a turbulent field FLORINE PARAZ, MAHESH BANDI, OIST — Whereas Kolmogorov's turbulence theory concerns an instantaneous field average, an Eulerian temporal velocity (v) measurement with Taylor's hypothesis suffices to obtain the famous -5/3 Kolmogorov spectrum. Yet, an Eulerian point cannot instantaneously encode the full field information. We ask, what is the minimum number of spatially discrete, temporal Eulerian point measurements needed to describe a turbulent field? Since both the Eulerian point and field spectra yield the same -5/3 exponent, we focus on higher order spectra ($v^m, m > 1$) to analyse the scaling differences between the point and the field. The spectral scaling of v^m as a function of the number of sampled spatial points then provides the convergence rate towards the asymptotic field average. We put this idea to experimental test in both two (2D) and three (3D) dimensional turbulence. Kolmogorov theory together with Random Sweeping arguments sets the scaling expectations for interpretation of the 3D turbulence data. However, we currently have no explanation for our 2D turbulence results.

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Date submitted: 31 Jul 2017 Electronic form version 1.4