Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

**Quantify the complexity of turbulence**[1] XINGTIAN TAO, HUIXUAN WU, University of Kansas — Many researchers have used Reynolds stress, power spectrum and Shannon entropy to characterize a turbulent flow, but few of them have measured the complexity of turbulence. Yet as this study shows, conventional turbulence statistics and Shannon entropy have limits when quantifying the flow complexity. Thus, it is necessary to introduce new complexity measures— such as topology complexity and excess information—to describe turbulence. Our test flow is a classic turbulent cylinder wake at Reynolds number 8100. Along the stream-wise direction, the flow becomes more isotropic and the magnitudes of normal Reynolds stresses decrease monotonically. These seem to indicate the flow dynamics becomes simpler downstream. However, the Shannon entropy keeps increasing along the flow direction and the dynamics seems to be more complex, because the large-scale vortices cascade to small eddies, the flow is less correlated and more unpredictable. In fact, these two contradictory observations partially describe the complexity of a turbulent wake. Our measurements (up to 40 diameters downstream the cylinder) show that the flow's degree-of-complexity actually increases firstly and then becomes a constant (or drops slightly) along the stream-wise direction.

[1]University of Kansas General Research Fund

Xingtian Tao
University of Kansas

Date submitted: 01 Aug 2017 Electronic form version 1.4