Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Fluctuations in spectral energy transfer and their consequences SUALEH KHURSHID, DIEGO DONZIS, Department of Aerospace Engineering, Texas A&M University, KATEPALLI SREENIVASAN, New York University — The assumption in Kolmogorov's seminal work, as well as in all the subsequent work of that genre, is that the average energy transfer across scales is unidirectional, from the large to the smallor, in the case of homogeneous turbulence, from low wavenumbers to high wavenumbers. This assumption would be quite acceptable if the fluctuations in the energy transfer rate were small compared to the mean. But the energy transfer rate is a highly fluctuating quantity, which is nearly as often in the backward direction as forward, and the mean transfer is only a small difference between the two, suggesting the need to consider fluctuations explicitly. In this work, we characterize the fluctuations in wavenumber space, of the energy itself and energy transfer rate, for a range of Reynolds numbers, using highly resolved direct numerical simulations. The simulations allow us to study dynamical interactions across scales and quantitatively address questions such as localness or otherwise of energy transfer in the spectral space. We show that the total transfer rate is indeed local in wavenumber space, though the information about large scales is preserved by means of the low-frequency and low-amplitude fluctuations that traverse from low to high wavenumbers with increasing time lag.

Sualeh Khurshid
Department of Aerospace Engineering, Texas A&M University

Date submitted: 29 Jul 2019 Electronic form version 1.4