DFD20-2020-001460
T

Abstract for an Invited Paper
for the DFD20 Meeting of
the American Physical Society

**Space-time energy spectra in turbulent flows**

GUOWEI HE, TING WU, Chinese Academy of Science

Space-time energy spectra of velocity fluctuations describe energy distribution in turbulent flows over length and time scales. They are used to study spatio-temporal dynamics of turbulent flows, such as energy transfer, coherent structures and decorrelation processes. The growing applications of large-eddy simulation to turbulence-generated noise and fluid-structure interaction also require the accurate prediction of space-time energy spectra. Historically, Taylor's frozen-flow hypothesis for weakly shear flows and Kraichnan's random sweeping hypothesis for isotropic turbulence are the well-known models for space-time energy spectra. In the present talk, we will first introduce the elliptic approximation model for space-time energy spectra, which takes Taylor and Kraichnan models as two limits. Second, we will present a simple stochastic model which includes the minimal dynamics of the Navier-Stokes equations and a dynamic autoregressive (DAR) force. This model can exactly reproduce the first and second order moments of space-time energy spectra. Finally, the DAR model in combination with linear stochastic estimation will be used to generate the near-wall velocity fluctuations which are missing in wall modeling.