Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Scale-to-scale energy and enstrophy transport in two-dimensional Rayleigh-Taylor turbulence[1] QUAN ZHOU, Shanghai Institute of Applied Mathematics and Mechanics, Shanghai University — We apply a recently developed filtering approach, i.e. filter-space technique (FST), to study the scale-to-scale transport of kinetic energy, thermal energy, and enstrophy in two-dimensional (2D) Rayleigh-Taylor (RT) turbulence. Although the scaling laws of the energy cascades in 2D RT system follow the Bolgiano-Obukhov (BO59) scenario due to buoyancy forces, the kinetic energy is still found to be, on average, dynamically transferred to large scales by an inverse cascade, while both the mean thermal energy and the mean enstrophy move toward small scales by forward cascades. In particular, there is a reasonably extended range over which the transfer rate of thermal energy is scale-independent and equals the corresponding thermal dissipation rate at different times. This range functions similar to the inertial range for the kinetic energy in the homogeneous and isotropic turbulence. Our results further show that at small scales the fluctuations of the three instantaneous local fluxes are highly asymmetrically distributed and there is a strong correlation between any two fluxes. These small-scale features are signatures of the mixing and dissipation of fluids with steep temperature gradients at the fluid interfaces.

[1]This work was supported by NSFC under Grant No. 11572185.

Quan Zhou
Shanghai Institute of Applied Mathematics and Mechanics, Shanghai University

Date submitted: 28 Jul 2016 Electronic form version 1.4