Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Turbulence energy cascade associated with hierarchical energy spectrum KIYOSI HORIUTI, KENSAKU SAITO, Tokyo Institute of Technology — The role of the hierarchical energy spectrum which was extracted in forced homogeneous isotropic turbulence (Horiuti *et al.* 2008) in the generation of the energy cascade is studied. It is shown using the DNS data that the temporal variations of the spectrum are divided into the two phases. Analysis of the energy transfer function in the Fourier space reveals that a large energy input occurs at the scale corresponding to the integral length in Phase 1, and the stretched spiral vortex which induces the $-7/3$ spectrum is created associated with this energy input. Creation of this input is attributable to the backward cascade of the energy in the high wavenumber range to the low wavenumber range in addition to the effect of forcing. The energy contained in the low-wavenumber range in Phase 1 is cascaded to the small scales in Phase 2. The spiral vortex in Phase 1 is converted into another mode of configuration which gives the $-5/3$ spectrum in Phase 2 and this mode becomes predominant. Moderately large dissipation events primarily occurs in Phase 2, but the dissipation field is more intermittent in Phase 1 than in Phase 2. The extreme events in dissipation and enstrophy fields overlap in space in Phase 1. These events occur along the vortex sheets of the spiral vortex which are strained and stretched by the vortex tube in its core.

Kiyosi Horiuti
Tokyo Institute of Technology

Date submitted: 31 Jul 2008 Electronic form version 1.4