Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Inertial Subrange Spectra in the Log-Law Layer of Turbulent Channel Flow YUKIO KANEDA, Aichi Institute of Technology, KOJI MORISHITA, Kobe University, TAKASHI ISHIHARA, Nagoya University — High resolution direct numerical simulations (DNSs) of turbulent channel flows with the friction Reynolds number Re_τ up to 5120 show that there exists a layer at y^+ being approximately between 200 and 1200, in which the mean velocity profile and the diagonal components of the inertial subrange velocity correlation spectra fit well to the logarithmic law and the $k^{-5/3}$ law, respectively. Here y^+ is the distance from the wall normalized by the wall unit, and k is the wavenumber in the stream wise direction. The DNS data suggest that in the layer (log-law layer), there exists a high wave number range in which the influence of the mean flow on the turbulence statistics may be regarded to be small as compared to that of nonlinear interactions between the small-scale eddies of size $\sim 1/$(wave number), so that the former influence may be treated as a perturbation added to the turbulent state determined by the nonlinear turbulence dynamics in the absence of the mean flow. A perturbation analysis on the basis of this idea yields a simple prediction for the anisotropic velocity correlation spectra in the inertial subrange. The DNS data agree fairly well with the prediction.

Yukio Kaneda
Aichi Institute of Technology

Date submitted: 02 Aug 2013 Electronic form version 1.4