Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Temporal behavior of strong shear layers in high Reynolds number turbulence PRADEEP K. JHA, TAKASHI ISHIHARA, Nagoya University, JST CREST — High resolution direct numerical simulation (DNS) of isotropic turbulence with the Taylor micro-scale Reynolds number $R_\lambda = O(10^3)$ on 4096^3 grid points was used to study the temporal behavior of strong shear layers in high Reynolds number turbulence. A time span of $10\tau_\eta = 2.55\lambda/u'$ was simulated and analyzed, where τ_η is the Kolmogorov time-scale, λ is the Taylor micro-scale and u' is the rms value of the velocity fluctuations. Detailed visualization showed excellent correspondence between regions with high enstrophy values and the existence of strong shear layers. Reasonably close-packed elongated strong vortices were found to exist in layer-like regions with thickness of the order of λ. A quantitative analysis of the DNS data showed that in these strong shear layers, strong vortices interact with the neighboring vortices and move drastically at a speed of the order of u', maintaining an effectively constant distance between each other. The average size of these peak vortices also remains quasi-time-independent. The strong shear layers at the interfacial region remain sharp during the time evolution. These shear layers are significant intermittent structures of high Reynolds number turbulence.

Takashi Ishihara
Nagoya University, JST CREST

Date submitted: 02 Aug 2013 Electronic form version 1.4