Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Lagrangian conditional statistics, acceleration and local relative motion in direct numerical simulations of turbulence[1] P.K. YEUNG, Georgia Tech., S.B. POPE, Cornell Univ., E.A. KURTH, Georgia Tech, A.G. LAMORGESE, Cornell Univ. — Lagrangian statistics of fluid particle velocity and acceleration conditioned on fluctuations of dissipation, enstrophy and pseudo-dissipation representing local relative motion in the flow are extracted from a direct numerical simulation (DNS) database of forced, stationary isotropic turbulence. The grid resolution is up to 2048^3, and the Taylor-scale Reynolds number covers a range up to about 650. Conditional velocity autocorrelations are consistent with rapid changes for the velocity of fluid particles moving in regions of large velocity gradients. Autocorrelations conditioned on the enstrophy show distinctive features which are, through the use of coordinate axes parallel and perpendicular to the vorticity vector, traced to vortex-trapping effects studied by others in the literature. However, rapid changes in vorticity vector orientation make these effects weaker at high Reynolds numbers. Further results including conditional velocity-acceleration cross-correlations, which involve a degree of flow detail currently accessible only in DNS, are also used to help develop a new stochastic model that accounts for the effects of turbulence intermittency at the small scales.

[1]Supported by NSF Grants CTS-0328314 (PKY) and 0328329 (SBP)

Pui-kuen Yeung
Georgia Institute of Technology

Date submitted: 02 Aug 2006

Electronic form version 1.4