Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Effect of the initial conditions on scalar dispersion in uniform-density grid turbulence[1] JEAN-FRANCOIS KRAWCZYNSKI, DANIEL LANG, PAUL DIMOTAKIS, California Institute of Technology — According to the equilibrium similarity analysis, self-preservation solutions are valid at all scales of motion for many 'classical' flows. In grid-turbulence for example, the energy decay rate is of a power-law form and can depend on initial conditions, hence decay-rate constants cannot be universal, except possibly in the limit of "infinite" Reynolds number. Most of the earlier attempts to validate this theory do not cover a sufficiently wide range of initial conditions or decay times. In the present work, a passive scalar is released from a point source in uniform-density grid turbulence (downstream of a towed grid) using three different momentum-flux conditions: 1) a momentum-less-wake condition, 2) a wake condition, and 3) a jet condition. Using laser-induced fluorescence techniques, data obtained from stream-wise cuts of the scalar field are recorded for the complete turbulence decay range, with varying initial Reynolds numbers based on the mesh length of the grid reaching $\mathrm{Re}_M = 5.6\times10^4$. Using fitting parameters to extract the power-law decay range, the scaling for the different inflow conditions is computed and differences are discussed. It is shown that scalar dispersion in grid turbulence retains the influence of the initial conditions over the entire decay range.

[1]Supported by AFOSR.

Jean-Francois Krawczynski
California Institute of Technology

Date submitted: 11 Aug 2009

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