Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Exploring the link between intermittency in scalar dissipation (χ) and energy dissipation (ε) rates SIDDHARTHA VERMA, GUILLAUME BLANQUART, California Institute of Technology — The occurrence of spatial and temporal intermittency in χ, analogous to that seen in ε for the velocity field, poses a formidable challenge in the formulation of subgrid scale models for χ. As the scalar transport equation is known to be linear, intermittency in the scalar field must be inherited largely from non-linearity in the momentum equation. This occurrence may be explained physically as the coincidence of steepest gradients in the scalar field (which correspond to the largest magnitudes of χ) with those in the velocity field (largest magnitudes of ε), caused by strong straining of material particles. To determine the extent of the inheritance, we attempt to establish a qualitative as well as quantitative correlation between intermittency in ε and χ. Any external role of the scalar forcing term in the intermittency of χ is also assessed by using two scalar forcing techniques in homogeneous isotropic turbulence, namely mean scalar gradient forcing and linear scalar forcing. A third, unforced configuration, the turbulent mixing layer is used as well, where scalar fluctuations are sustained naturally by a mean gradient present in the cross-stream direction. Appropriate conclusions are also drawn regarding the relevance of the Schmidt number to the extent of intermittency inheritance, in light of the spectral de-linking that happens at very high Schmidt numbers.

Siddhartha Verma
California Institute of Technology

Date submitted: 02 Aug 2013 Electronic form version 1.4