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Local structure of scalar flux in turbulent passive scalar mixing
ADITYA KONDURI, DIEGO DONZIS, Texas A&M University — Understanding the properties of scalar flux is important in the study of turbulent mixing. Classical theories suggest that it mainly depends on the large scale structures in the flow. Recent studies suggest that the mean scalar flux reaches an asymptotic value at high Peclet numbers, independent of molecular transport properties of the fluid. A large DNS database of isotropic turbulence with passive scalars forced with a mean scalar gradient with resolution up to 4096^3, is used to explore the structure of scalar flux based on the local topology of the flow. It is found that regions of small velocity gradients, where dissipation and enstrophy are small, constitute the main contribution to scalar flux. On the other hand, regions of very small scalar gradient (and scalar dissipation) become less important to the scalar flux at high Reynolds numbers. The scaling of the scalar flux spectra is also investigated. The $k^{-7/3}$ scaling proposed by Lumley (1964) is observed at high Reynolds numbers, but collapse is not complete. A spectral bump similar to that in the velocity spectrum is observed close to dissipative scales. A number of features, including the height of the bump, appear to reach an asymptotic value at high Schmidt number.

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