Passive scalar advection in parallel shear flows: WKBJ mode sorting on intermediate times[1] RICHARD MCLAUGHLIN, ROBERTO CAMASSA, CLAUDIO VIOTTI, University of North Carolina, NSF UNC RTG FLUIDS GROUP COLLABORATION — The evolution of a passive scalar diffusing in simple parallel shear flows is a problem with a long history. In 1953, GI Taylor showed theoretically and experimentally that on long times, the passive scalar experiences an enhanced diffusion in the longitudinal direction. On shorter times the scalar evolution is anomalous, characterized by second moments growing faster than linear in time as we show by analysis of the stochastic differential equations underlying the passive scalar equation. The spatial structures associated with this intermediate time evolution are predicted using WKBJ analysis of an associated non-self adjoint eigenvalue problem. This analysis predicts a sorting of wall modes and interior modes with specific predictions of the decay and propagation rates as a function of the Peclet number.

[1]NSF

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