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Enhanced Spectral Transfer in Weakly Mixing Regions of a Turbulent Flow[1] LEI FANG, NICHOLAS OUELLETTE, Stanford University, SANJEEVA BALASURIYA, University of Adelaide — Scale-to-scale spectral energy flux is a hallmark of turbulent flows. The geometric alignment of small-scale turbulent stress and large scale rate of strain leads to the net flux of energy from small scales to large scales in 2D turbulence. We have found, however, that the instantaneous alignment between these two tensors is surprisingly weak, and thus that the spectral transport of energy is inefficient. In our experimental work, we have shown that the strain rate is much better aligned with the stress at times in the past, suggesting that the differential advection of the two is responsible for the inefficient spectral transfer. Based on this understanding, we developed a tool to specifically look for weakly mixing regions in the flow based on the linearity this implies, which we term Linear Neighborhoods (LNs). We demonstrate that these LNs are computable in real data using experimental measurements from a 2D turbulent flow. Consistent with our previous results, we find that that the spectral energy flux behaves differently inside the LNs, where the spectral energy flux is more efficient. Our results add additional support to the conjecture that turbulent flows locally tend to transport energy and momentum in space or between scales but not both simultaneously.

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