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Emergence of turbulent behavior for passive scalars DIEGO DONZIS, Texas A&M University, K.R. SREENIVASAN, NYU, V. YAKHOT, Boston University — We recently identified a transition to strong turbulence in isotropic turbulence with stochastic forcing. We found that the higher the order of the derivative moment the lower the transition Reynolds number. By a suitably rescaling, we could reduce the transition value to a universal Reynolds number of the order 10 for all orders. The moments of velocity gradients are Gaussian below this transition Reynolds number and exhibit anomalous scaling above, with the same scaling exponents as high-Reynolds-number turbulence. The matching of the two asymptotic states led to analytical expressions for scaling exponents in excellent agreement with available data. In this work we extend these concepts to passive scalar mixing. We observe a similar type of transition with the same Gaussian asymptotic behavior at low Reynolds numbers, but the transition Reynolds number depends on the Schmidt number (the ratio of viscosity to scalar diffusivity), and the matching of the two regimes yields scaling exponents that depend on the Schmidt number. The connection with the so-called ramp-cliff structures is also discussed. As for the velocity field, these results suggests that high-Reynolds-number behavior can be studied via well-resolved simulations around this low-Reynolds-number transition.

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