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Turbulent mixing of substances which are highly diffusive[1] K.R. SREENIVASAN, New York Univ., P.K. YEUNG, Georgia Tech — How a substance gets mixed by a fluid, even when the motion is turbulent, depends to some extent on whether its diffusivity is small or large. The magnitude of the diffusivity is usually expressed by the Schmidt number (Sc, ratio of fluid viscosity to the diffusivity of the substance). The case of passive scalars (which have no back-reaction on the flow) with large Sc (weak diffusivity) has received considerable attention, especially for its special features such as the -1 power roll-off of the spectrum of the fluctuations. Similar studies for passive scalars at low Schmidt numbers (or large diffusivity) do not yet exist, though the classical theory (Batchelor, Howells & Townsend, J. Fluid Mech, **5**, 134 (1959)) is now more than fifty years old. In this talk we report direct numerical simulations for decaying scalar fields with Sc as low as 1/2048, at grid resolution up to 4096^3, in stationary isotropic turbulence with microscale Reynolds number in the range 140-390. We examine the validity of theoretical assumptions that lead to a spectral slope of -17/3 in the so-called inertial-diffusive range. Despite limitations on the range of scales in the simulations, the data support the theory as the Schmidt number decreases and the Reynolds number increases.

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