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Schmidt-number dependence in turbulent mixing: very low Schmidt numbers and spectral transfer[1] P.K. YEUNG, Georgia Tech, K.R. SREENIVASAN, New York Univ, K.P. IYER, D. BUARIA, Georgia Tech — The physics of turbulent mixing depends on both the Reynolds number and Schmidt number (Sc), which varies widely in applications and leads to different scaling regimes. The case of $Sc \ll 1$, which is relevant in liquid metals and astrophysics, is perhaps the least understood since laboratory data are difficult to obtain. We have performed direct numerical simulations of passive scalars of Sc from 1/32 to 1/512, on a periodic domain of larger size than usual to accommodate the growth of large scales in the scalar fields, and with a very small time step to resolve the time scales of molecular diffusion. For $Sc = 1/128$ and $1/512$ the spectrum obtained appears to support $k^{-17/3}$ inertial-diffusive behavior proposed by Batchelor, Howells & Townsend (1959) although results at higher Reynolds numbers are required. Calculations of spectral transfer, including the transfer flux, indicate that the spectral cascade is greatly suppressed, which implies a number of classical notions such as dissipative anomaly and local isotropy become inapplicable in this regime. Together with other recently published data the new results also enable progress towards a unified view of Schmidt number dependence for small-scale turbulent mixing.

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Pui-kuen Yeung
Georgia Inst of Tech

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