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Asymptotic form of the PDF of scalar dissipation rate in isotropic turbulence[1] DIEGO DONZIS, P.K. YEUNG, Georgia Tech, K.R. SREENIVASAN, ICTP, Italy & U. Maryland — An accurate knowledge of the probability density function (PDF) of scalar dissipation rate fluctuations is important for numerous reasons, such as small-scale intermittency and local flame extinction in turbulent reacting flows. Previous work in the literature suggest the wide tails of the scalar dissipation PDF can be described by stretched exponential fits whose parameters are Reynolds- and Schmidt-number dependent. We consider the asymptotic form of this PDF using direct numerical simulation data in isotropic turbulence at resolution up to 2048^3 covering Taylor-scale Reynolds numbers from 8 to 700 and Schmidt numbers from 1/8 to 1024. For moderately diffusive scalars ($Sc = O(1)$) the stretched-exponential parameters are consistent with an increase in intermittency with Reynolds number similar to energy dissipation and enstrophy. For weakly-diffusive scalars ($Sc \gg 1$) saturation of intermittency occurs beyond a value of Sc which decreases with increasing Reynolds number. In general, the stretched-exponential form predicts higher-order moments more accurately than the log-normal hypothesis used often in modeling. We also discuss the PDF of scalar dissipation averaged locally over a box of size falling in the classical inertial-convective and viscous-convective ranges.

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