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Turbulence computations on a 4096^3 periodic domain: passive scalars at high Schmidt number and Lagrangian statistics conditioned on local flow structure[1] PUI-KUEN YEUNG, Georgia Tech, D.A. DONZIS, Texas A&M Univ., K.R. SREENIVASAN, New York Univ., B.L. SAWFORD, Monash Univ., Australia, S.B. POPE, Cornell Univ. — Rapid advances in Cyberinfrastructure, with more to come on the horizon, are presenting many opportunities for extending simulations of turbulence towards previously inaccessible parameter regimes and improved results in problems with greater complexity. In our group we have performed 4096^3 simulations of isotropic turbulence on three massively parallel machines to study turbulence at higher Reynolds number, higher Schmidt number, or better resolution than usually practiced. One topic studied is Batchelor scaling and small-scale intermittency of passive scalar fields in turbulent mixing at high Schmidt number with a demonstrable viscous-convective range. Another is the behavior of Lagrangian structure functions at high Reynolds number ($R_\lambda \approx 1000$), with conditional sampling used to distinguish between the characteristics of strain-dominated versus rotation-dominated regions of the flow. We shall discuss both problems briefly, and conclude with an overview of current and future challenges involved in striving towards the next level, involving Petascale computing and beyond.

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Pui-kuen Yeung
Georgia Tech

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