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On the smallest sub-kolmogorov mean length scale and its implications on phenomenology LAKSHMI DASI, SUBHAS VENAYAGAMOORTHY, Colorado State University, Fort Collins CO — The smallest scale in turbulence has been predicted to be less than the Kolmogorov scale η by a factor of $\mathrm{Re}^{1/4}$ and attributed to the intermittency of the turbulent kinetic energy dissipation rate ε. We show through dimensional arguments that this smallest limit corresponds to a new mean length scale based on turbulent kinetic energy k and kinematic viscosity ν, given by $(\nu^2/k)^{1/2}$. The independence of this scale with ε raises the issue of physical dependence of length scales and challenges classical phenomenology. Thus the notion that the smallest scales are set by the intermittent fluctuations of dissipation rate may be physically in-accurate. Given that ε is also set independently by the large scale and the turbulent kinetic energy, the physical consequence is that the dissipative portion of energy cascade is constrained between η and $(\nu^2/k)^{1/2}$. Another important implication stems from the fact that $(\nu^2/k)^{1/2}$ is a mean length scale. This alludes to the existence of even smaller scales of motion in the instantaneous field that are governed by the fluctuations in turbulent kinetic energy.

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