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The bottleneck effect and the Kolmogorov constant in three-dimensional turbulence[1] DIEGO DONZIS, Texas A&M University, K.R. SREENIVASAN, ICTP, Italy; U. Maryland — A large database generated from direct numerical simulations (DNS) of isotropic turbulence, including recent simulations at up to 4096^3 resolution and Taylor microscale Reynolds numbers of up to about 1000, is used to explore the bottleneck effect in three-dimensional energy spectrum and in second-order structure functions, and to determine the Kolmogorov constant, C_K. The difficulties in estimating C_K at any finite Reynolds number are examined. Our data from well-resolved simulations show that the bottleneck effect decreases with the Reynolds number and that its behavior is independent of the nature of the forcing scheme and is insensitive to small-scale resolution. This trend is seen in both spectral and physical spaces, though the effect is less noticeable in the latter. An alternative to the usual procedure for determining C_K is suggested. The proposal does not depend on a particular choice of fitting ranges or power-law behavior in the inertial range. Within the resolution of the numerical data, C_K thus determined is constant in the Reynolds number. A simple model including non-local energy transfer is proposed to reproduce the observed scaling. Further implications of the findings are discussed.

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