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Fluctuations in the energy input determine Kolmogorov constants in turbulence GREGORY BEWLEY, Max Planck Institute for Dynamics and Self-Organization, FLORENT LACHAUSSÉE, École Normale Supérieure, JOHANNES KASSEL, University of Göttingen, GREG VOTH, Wesleyan University, EBERHARD BODENSCHATZ, Max Planck Institute for Dynamics and Self-Organization — Attention to turbulence is often focused, for good reason, on flows that either maintain a steady state or decay freely. But these conditions are not typical in natural or industrial flows. We ask what effect deviations from these conditions have on the turbulence itself. To answer the question, we employ a new active grid with many independently controllable degrees of freedom to generate turbulence in a wind tunnel. We find the following: The anisotropy in the flow can be set to various states, including an isotropic one, by adjusting the correlations between motions on the grid. Some part of the fluctuations in the flow can be attributed to the instantaneous configuration of the grid, in the sense that it is reproduced when the grid returns to the same configuration. The value of the Kolmogorov constants for the structure functions of different order can be adjusted by changing over time the degree to which the active grid agitates the flow. We interpret these variations in agitation as variations of the energy input rate. We then find that the Kolmogorov constants, in particular those of order higher than two, can be made to have universal values when the variation of the energy input rate is accounted for by a model based on the refined similarity theory.

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