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The role of wall confinement on the decay rate of an initially isotropic turbulent field[1] DAVID R. DOWLING, POOYA MOVAHED, ERIC JOHNSEN, University of Michigan, Ann Arbor — The problem of freely decaying isotropic turbulence has been the subject of intensive research during the past few decades due to its importance for modeling purposes. While isotropy and periodic boundary conditions assumptions simplify the analysis, large-scale anisotropy (e.g., caused by rotation, shear, acceleration or walls) is in practice present in most turbulent flows and affects flow dynamics across different scales, as well as the kinetic energy decay. We investigate the role of wall confinement and viscous dissipation on the decay rate of an initially isotropic field for confining volumes of different aspect ratios. We first generate an isotropic velocity field in a cube with periodic boundary conditions. Next, using this field, we change the boundary conditions to no-slip walls on all sides. These walls restrict the initial field to a confined geometry and also provide an additional viscous dissipation mechanism. The problem is considered for confining volumes of different aspect ratios by adjusting the initial field. The change in confining volume introduces an additional length scale to the problem. Direct numerical simulation of the proposed set-up is used to verify the scaling arguments for the decay rate of kinetic energy.

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