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Size effects in the turbulent tumbling of thin rods and large particles NIMISH PUJARA, THERESA OEHMKE, University of California, Berkeley, GREG VOTH, Wesleyan University, EVAN VARIANO, University of California, Berkeley — We present experimental, numerical, and theoretical results on rotation of finite-sized, neutrally buoyant, anisotropic particles in isotropic turbulence. By using particles of different shapes and sizes, we explore the effects of particle length scales on rotation. Previous results showed that the leading-order determinant of particle rotation is particle volume (at least for low-aspect-ratio particles) suggesting that shape does not affect the lower order statistics. We offer a possible explanation for this, based on the postulate that the particles finite-size effects allow them to be stable with respect to Lagrangian turbulent flow structures which would otherwise align them with coarse-grained vorticity and strain-rate. We test this hypothesis by comparing experimental data with results from computations of inertialess particles forced with a stochastically-generated time series of the velocity gradient tensor based on random flow, which accounts for the particle filtering effect. A second approach to understanding the dynamics is to quantify the alignment statistics between large thin rods and the coarse-grained velocity tensor, which quantifies the way in which the alignment between fluid vorticity and particles long axes evolves with particle length scale.

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