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Inertial Range Scaling of Rotation Rates of Particles in Turbulence BRENDAN COLE, STEFAN KRAMEL, GREG VOTH, Wesleyan Univ — We measure mean-squared rotation rates of 3D-printed particles with sizes spanning the inertial range in a turbulent flow between oscillating grids. Tetrads, composed of four slender rods in tetrahedral symmetry, and triads, three slender rods in triangular planar symmetry, are tracked in a flow with $Re_\lambda = 156$ and $Re_\lambda = 214$ using four high-speed cameras. Tetrads rotate like spheres and triads rotate like disks. Measurements of tetrads' rotation rates as a function of particle size are direct measurements of the coarse-grained vorticity and provide a new way to measure inertial range scaling in turbulent flows. Similar measurements of rods, performed by Parsa and Voth, were consistent with the $< \omega^2 > \sim r^{-\frac{4}{3}}$ scaling prediction, but the preferential alignment of rods affects their rotation rate and this preferential alignment could not be directly measured. Our triads allow measurement of the full solid-body rotation rate as well as the particle orientation and so we can quantify the preferential alignment for disks.

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