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Lagrangian Measurements of Vorticity and the Rotational Dyanmics of Anisotropic Particles in Turbulence GUY GEYER, SHIMA PARSA, STEFAN KRAMEL, GREG VOTH, Wesleyan University — We measure the Lagrangian rotational dynamics of anisotropic particles in turbulent flow using stereoscopic video imaging. Using 3D printing technology, we fabricate rods, crosses (two perpendicular rods), and jacks (three mutually perpendicular rods). The three dimensional position and orientation of these objects can be reconstructed using a combination of stereomatching and optical tomography. We apply these techniques to measurements in a $R_\lambda \approx 200$ flow, where turbulence is generated by two grids oscillating in phase. Since the advected particles have a largest dimension less than 10 times the Kolmogorov length, they are good approximations of tracer particles. Using resistive force theory, we demonstrate that tracer jacks and crosses have the same rotational dynamics as spheres and disks, respectively. Thus, we can measure the rotation rates of ellipsoidal particles at aspect ratios, α, that span the entire range: $\alpha \approx 0$ (disks) $\alpha = 1$ (spheres), and $\alpha \approx \infty$ (rods). Furthermore, measurements of the rotation rate of jacks constitute a novel method for obtaining Lagrangian measurements of the vorticity in turbulent flows.

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