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Preferential sampling of Lagrangian velocity gradients by tumbling rods in turbulence RUI NI, Yale University, STEFAN KRAMEL, Wesleyan University, NICHOLAS T. OUELLETTE, Yale University, GREG VOTH, Wesleyan University — Advances in fast stereoscopic imaging now allow us to study the motion of anisotropic particles in turbulent flow. But to get a complete picture of the tumbling dynamics of anisotropic particles, we need additional information from the surrounding fluid flow. Using a new scanning particle tracking system, we report simultaneous measurements of the tumbling motion of anisotropic particles and the velocity gradient of the flow near them, which provide a rich dataset with five scalars characterizing the velocity gradient tensor and two scalars describing the relative orientation of the rod. Using conditional statistics, we find that the squared tumbling rate of rod is small on average because the rod is preferentially aligned with the vorticity vector. It tends to be much larger, however, than its mean value when the rod is oriented at a particular angle with respect to the eigenvector of the strain-rate tensor corresponding to the smallest eigenvalue, because this particular orientation maximizes the contribution from both the vorticity and strain.

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