Abstract Submitted
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Rotations of long, inertialess rods in turbulence NIMISH PUJARA, EVAN VARIANO, Univ of California - Berkeley, GREG VOTH, Wesleyan University — We present results on rotation of rods with lengths varying through the inertial range in turbulence. Rod motion is computed using one-way coupling in the Johns Hopkins University Turbulence Database of homogenous isotropic turbulence at $Re_\lambda = 433$. We consider zero-volume, zero-inertia rods, whose motion we model by advecting two tracer particles with constant distance between them. By making the tumbling rate dimensionless with a timescale that corresponds to turbulent motions of the same size as the rod, we show that such motions are responsible for the most of the variance in rod tumbling. Flatness factors for tumbling show that large deviations from the mean tumbling rate become less frequent as rod length increases, suggesting that longer rods are less responsive to intermittent events in turbulence. Finally, to investigate how such rods respond to turbulent flow forcing at their scale, we calculate the coarse-grained velocity gradient tensor by fitting to the velocity field sampled at discrete points within the sphere that circumscribes the rod. Results of instantaneous rod alignment with the vorticity and strain-rate eigenvectors of this tensor enable us to understand the preferential orientation of rods with respect to the flow field they are experiencing.

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