Abstract Submitted
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Effect of fluid inertia on the orientation of a small spheroid settling in turbulence[1] BERNHARD MEHLIG, University of Gothenburg — We study the angular dynamics of small non-spherical particles settling in a turbulent flow. Most solid particles encountered in Nature are not spherical, and their orientations affect their settling speeds, as well as their collision and aggregation rates in suspensions. Whereas the random action of turbulent eddies favours an isotropic distribution of orientations, gravitational settling breaks the rotational symmetry. We demonstrate here that the fluid-inertia torque plays a dominant role in the problem. As a consequence rod-like particles tend to settle horizontally in turbulence, the more so the larger the settling number Sv (a dimensionless measure of the settling speed). For large Sv we determine the fluctuations around this preferential horizontal orientation for prolate particles with arbitrary aspect ratios, assuming small Stokes number St (a dimensionless measure of particle inertia). This overdamped theory predicts that the orientation distribution is very narrow at large Sv, with a variance proportional to Sv^{-4} for rods and Sv^{-8} for disks. The abstract is based mainly on arXiv:1904.00481 (New Journal of Physics https://doi.org/10.1088/1367-2630/ab3062).

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