

Abstract Submitted
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Measurements of orientation, sedimentation, and dispersal of ramified particles in isotropic turbulence¹ GREG A. VOTH, STEFAN KRAMEL, Wesleyan University, UDAYSHANKAR K MENON, DONALD L. KOCH, Cornell University — We experimentally measure the sedimentation of non-spherical particles in isotropic turbulence. We obtain time-resolved 3D orientations of the particles along with the fluid velocity field around them in a vertical water tunnel. An active jet array with 40 individually controllable jets enables us to adjust the turbulence intensity and observe the transition from strongly aligned to randomized particle orientations. We focus on the orientation statistics of ramified particles formed from several slender arms, including fibers and particles with three arms in planar symmetry (triads), which allows us to study alignment of both fibers and disk-like particles. We can predict the turbulent intensity at which the transition from aligned to randomized particle orientations occurs using a non-dimensional settling factor given by the ratio of rotation timescale of the turbulence at the scale of the particle to the rotation timescale of a particles in quiescent flow due to inertial torques. A model of ramified particle motion based on slender body theory provides accurate predictions of the vertical and horizontal particle velocities relative to the turbulent fluid.

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