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Micro-bubbles and Micro-particles are Not Faithful Tracers of Turbulent Acceleration CHAO SUN, Center for Combustion Energy and Department of Thermal Engineering, Tsinghua University, China., VARGHESE MATHAI, Physics of Fluids Group, University of Twente, The Netherlands., ENRICO CALZAVARINI, Univ. Lille, CNRS, FRE 3723, LML, Laboratoire de Mecanique de Lille, F 59000 Lille, France., JON BRONS, DETLEF LOHSE, Physics of Fluids Group, University of Twente, The Netherlands. — We report on the Lagrangian statistics of acceleration of small (sub-Kolmogorov) bubbles and tracer particles with Stokes number St $\ll 1$ in turbulent flow. At decreasing Reynolds number, the bubble accelerations show deviations from that of tracer particles, i.e. they deviate from the Heisenberg-Yaglom prediction and show a quicker decorrelation despite their small size and minute St. Using direct numerical simulations, we show that these effects arise due the drift of these particles through the turbulent flow. We theoretically predict this gravity-driven effect for developed isotropic turbulence, with the ratio of Stokes to Froude number or equivalently the particle drift-velocity governing the enhancement of acceleration variance and the reductions in correlation time and intermittency. Our predictions are in good agreement with experimental and numerical results. The present findings are relevant to a range of scenarios encompassing tiny bubbles and droplets that drift through the turbulent oceans and the atmosphere.

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