

Abstract Submitted
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Preliminary investigation of the effect of electric charge on particle-pair relative velocity in isotropic turbulence¹ ADAM HAMMOND, University at Buffalo SUNY, ZHONGWANG DOU, Johns Hopkins University, TUSHAR KAILU, ZACH LIANG, HUI MENG, University at Buffalo SUNY — In many particle-laden turbulent flows including thunderstorm clouds and aerosol sprays, the particles may be electrically charged. How the Coulomb force between charged particles competes with the turbulence forces on particle motion is not yet fully understood. Mean inward particle pair relative velocity (particle RV), a quantity relevant for particle collision in isotropic turbulence, is expected to be affected by charge. We extend our recent particle tracking velocimetry (PTV) study on particle pair relative velocity in fan-driven isotropic turbulence to particles with charge. To accomplish this, we established a method to independently vary particle charge distributions by balancing particle density and size while keeping constant Re_λ and St , developed a unique instrument to measure particle charge using in-line holography, and measured particle RV using PTV at three levels of charge under a single flow condition. We present charged particle RV measurements from the experiments at $Re_\lambda = 343$, $St \approx 1.19$, and charge of order 10^{-15} Coulombs, which show that particle RV increases with magnitude of bipolar charge. This study paves the way for a comprehensive exploration of relative motion of charged particle in isotropic turbulence.

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