Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Experimental Exploration of Electrostatic Charge on Particle Pair Relative Velocity in Homogeneous and Isotropic Turbulence[1] ADAM HAMMOND, ZHONGWANG DOU, ANJAN TRIPATHI, ZACH LIANG, HUI MENG, University at Buffalo - SUNY — Study of droplet collision and cloud formation should consider the effects of both turbulence and electrostatic charge on particle dynamics. We present the first experimental observation of radial relative velocity (RV) of charged particles in homogeneous and isotropic turbulence (HIT). Charges on particles were generated through triboelectric effect between the inner wall of the chamber and the particles. To measure charge distribution, a particle-laden head-on impinging flow mimicking our HIT chamber conditions was built and holographic particle tracking was applied to quantify particle charges by measuring their displacements in an electric field. Particles were observed to have opposite charges. Next, in our HIT chamber, we measured particle RV by a novel 4-frame particle tracking velocimetry technique with and without charges on particles, wherein charges were neutralized by coating the interior of the HIT chamber with conductive carbon paint. We compared RV under the same turbulence conditions between charged particles and neutral particles and observed that when particles were oppositely charged, their mean inward RV increased at small separation distances. This result is consistent with recent theory and simulations (Lu and Shaw, Physics of Fluids, 2015).

[1]This work was supported by the National Science Foundation through a Collaborative Research Grant CBET-0967407

Hui Meng
University at Buffalo - SUNY

Date submitted: 01 Aug 2015 Electronic form version 1.4