Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Computational and experimental study of charged inertial particles in turbulence JIANG LU, Physics Department, Michigan Technological University, HANSEN NORDSIEK, Physics Department , University of Maryland, RAYMOND SHAW, Physics Department ,Michigan Technological University — We have investigated the behavior of electrically charged, inertial particles in homogeneous, isotropic turbulence. Specifically, a drift-diffusion theory describing the scale dependent radial distribution function (RDF) for the particles is evaluated computationally and experimentally. The experiments were carried out in a laboratory chamber that generates nearly homogeneous, isotropic turbulence, and seeded with uniformly charged water droplets. We also report results from a direct numerical simulation (DNS) of turbulence in a periodic box using the pseudospectral numerical method. The numerical study explicitly calculates the interactions of electrically charged inertial particles in homogeneous, isotropic turbulence. Conditions are selected to investigate the effects of mutual electrostatic repulsion of particles on their dynamics, sufficiently strong so as to mimic behavior of a nonideal gas: Coulomb interactions lead to short range repulsion overcoming inertial clustering below a shielding length as seen by a strong reduction in the RDF, but turbulence is sufficiently intense so as to suppress long range correlations (e.g., analogous to thermal energy leading to melting of a Coulomb crystal).

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Date submitted: 06 Aug 2011 Electronic form version 1.4