

Abstract Submitted  
for the DFD17 Meeting of  
The American Physical Society

**Contact Electrification of Suspended Particles in a Turbulent Fluid**<sup>1</sup> XING JIN, JEFFREY MARSHALL, University of Vermont — Contact electrification is a commonly observed phenomenon in which particles exchange charge during collisions in turbulent particulate flows. In various process industries, such as coal mining, sawmills, grain mills and storage facilities, contact electrification is known to lead to dangerous explosions of dust clouds. In natural particulate flow processes, such as sandstorms, volcanic eruptions, planetary rings, and ice transport within thunderstorms, contact electrification leads to development of electrical gradients, often resulting in lightning. In the current work, a probabilistic version of a well-known phenomenological model for contact electrification is used to examine the effect of fluid turbulence on charge development for suspended particles as a function of the particle Stokes number. The distribution of particle collisions and particle charge appear to approach asymptotic states for high values of the Kolmogorov-scale Stokes numbers, exhibiting approximately normal distributions. The influences on particle contact electrification of differences in initial charge carrier density and in particle size are examined.

<sup>1</sup>We gratefully acknowledge support from the U.S. National Science Foundation grant number CBET-1332472.

Jeffrey Marshall  
University of Vermont

Date submitted: 25 Jul 2017

Electronic form version 1.4