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Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

First Observation of a Hall Effect in a Dusty Plasma: A Charged Granular Flow with Relevance to Planetary Rings[1] SKYLAR EISKOWITZ, Cooper Union, NOLAN BALLEW, RUBN ROJAS, DANIEL LATHROP, University of Maryland — The particles in Saturn's rings exhibit complex dynamic behavior. They experience solar radiation pressure, electromagnetic forces, and granular collisions. To investigate the possibility of the Hall Effect in the dusty plasma that comprise Saturn's rings, we have built an experiment that demonstrates the Hall Effect in granular matter. We focus on the Hall Effect because the rings' grains become collisionally charged and experience Saturn's dipolar magnetic field and Lorentz forces as they orbit. The experimental setup includes a closed ring-like track where granular matter is forced to circulate driven by compressed air. The structure sits between two electromagnets so that a portion of the track experiences up to a 0.2 T magnetic field. We vary the strength of the field and the speed of the particles. We report the voltage differences between two conducting plates on opposite sides of the track. If Saturn's rings do experience the Hall Effect, the inside and outside of the rings will develop a charge separation that can lead to a radial electric field and various phenomena including orbital effects due to the additional electric forces. Observational evidence from Cassini suggests that Saturn's rings exhibit lighting, supporting the notion that they are electrically charged.

[1]TREND REU program sponsored by the National Science Foundation

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Date submitted: 01 Aug 2017 Electronic form version 1.4