Abstract Submitted
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Caltech water-ice dusty plasma: preliminary results[1] PAUL BELLAN, KILBYOUNG CHAI, Caltech — A water-ice dusty plasma laboratory experiment has begun operation at Caltech. As in Ref. [1], a 1-5 watt parallel-plate 13.56 MHz rf discharge plasma has LN2-cooled electrodes that cool the neutral background gas to cryogenic temperatures. However, instead of creating water vapor by in-situ deuterium-oxygen bonding [1], here the neutral gas is argon and water vapor is added in a controlled fashion. Ice grains spontaneously form after a few seconds. Photography with a HeNe line filter of a sheet of HeNe laser light sheet illuminating a cross section of dust grains shows a large scale whorl pattern composed of concentric sub-whorls having wave-like spatially varying intensity. Each sub-whorl is composed of very evenly separated fine-scale stream-lines indicating that the ice grains move in self-organized lanes like automobiles on a multi-line highway. HeNe laser extinction together with an estimate of dust density from the intergrain spacing in photographs indicates a 5 micron nominal dust grain radius. HeNe laser diffraction patterns indicate the ice dust grains are large and ellipsoidal at low pressure (200 mT) but small and spheroidal at high pressure (>600 mT).

[1] Shimizu et al [JGR 115, D18205 (2010)]

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