Abstract for an Invited Paper
for the APR06 Meeting of
The American Physical Society

Wave Experiments in Dusty Plasmas: Linear and Nonlinear

JOHN GOREE, The University of Iowa, Dept. of Physics and Astronomy

A dusty plasma is an ionized gas containing small particles of solid matter, which are typically nanometer or micron size. These particles gain a large electrical charge by collecting electrons and ions from the ambient plasma. Examples of astrophysical dusty plasmas include the interstellar medium, comet tails and the rings of Saturn. The charged particles in a dusty plasma act like highly-charged super-massive ions, except that their charge is not fixed. Like ions, they can oscillate in response to electric fields, so that waves can propagate. These waves have very low frequencies, due to the heavy mass of the particles. Laboratory experiments are done by seeding microspheres into a glow-discharge plasma. In the presence of gravity, they can form a horizontal layer levitated by the electric field of a sheath. These particles are imaged directly, using video cameras, as they move about. Experiments have been performed to observe compressional and shear electrostatic waves. Experiments with low-amplitude linear waves as well as high-amplitude nonlinear waves will be described. At high amplitudes, compressional waves exhibit three-wave mixing. These experiments were performed in dusty plasmas that are strongly-coupled, with particles arranged in an ordered structure like molecules in a liquid or solid. Work supported by DOE and NASA.