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Growth and nonlinearity in a self-excited dust-density wave[1] J. GOREE, T.M. FLANAGAN[2], The University of Iowa — Exponential growth and nonlinear saturation of waves in a dusty plasma were observed. Dust particles (4.8 micron polymer spheres) were introduced into an argon radio-frequency plasma. They collected a charge of order -10^3e. Due to a vertical dc E field, these charged dust particles were levitated against gravity and suspended as a 3D cloud within the plasma. A downward ion flow caused an unstable growth of the dust density wave. This wave is like an ion-acoustic wave, but with the inertia provided by heavy dust particles instead of ions, so that it had a low frequency of about 25 Hz. Frictional drag of the dust particles on the neutral gas damped the wave, in competition with the ion-driven instability mechanism. Below a critical gas pressure, a self-excited wave grew in amplitude as it propagated. We measured the exponential growth rate k_i during the wave's linear stage. Nonlinear waves were observed by further reducing the gas pressure. In this nonlinear stage we found that the harmonics had wave numbers and growth rates that were near integer multiples of those for the fundamental.

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