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Observation of the Rayleigh-Taylor instability in a dusty plasma[1]

K.A. PACHA, R.L. MERLINO, J.R. HEINRICH, S.H. KIM, University of Iowa — Lord Rayleigh showed that the interface between two fluids of different densities, with the dense fluid above a fluid of lesser density, is unstable to the growth of downward moving irregularities which develop into finger-like structures. Taylor showed that this situation is equivalent to one in which a lighter fluid is accelerated into a heavier fluid. We have observed a Taylor-type instability in a dusty plasma formed in a dc-glow discharge in argon at P = 13 Pa. The glow discharge is formed using a 4 cm diameter anode disk biased at 300 V with respect to the walls of a vacuum chamber. An axial magnetic field ∼30 mT confines the glow to a cylindrical region protruding outward from the anode. Micron size spherical iron particles are incorporated into the discharge from a floating tray located below the anode. The conical dust suspension is separated into a region of high dust density near the anode and a low density region farther from the anode. Periodically, the boundary of the high density region is locally perturbed by a pressure disturbance from the low density region. The surface irregularity grows rapidly, forming a bubble and spike, classic signatures of the Rayleigh-Taylor instability. The instability is studied with laser light scattering and video imaging.

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