



Dust density waves in complex plasmas

S. Zhdanov (1), M. Schwabe (1), M. Rubin-Zuzic (1), H. Thomas (1), G. Morfill (1)

(1) Max-Planck-Institut fuer extraterrestrische Physik, D-85741 Garching, Germany
(zh@mpe.mpg.de, schwabe@mpe.mpg.de, mrz@mpe.mpg.de, thomas@mpe.mpg.de,
gem@mpe.mpg.de)

We report on observations of dynamic patterns involving excitation and propagation of regular density waves in complex plasmas using rf discharges. In ground based experiments performed in Ar at pressures 10-40 Pa a cloud of small MF microparticles of 1.28 μm diameter is subjected to effective gravity in the range of 1– 4 g by thermophoresis. At higher pressures, the uniform microparticle cloud was levitated in the chamber, its position depending on the temperature gradient. When the gas pressure was then lowered to a “critical” level, self-excited density waves appeared. The critical pressure for the onset of the waves increases with the temperature gradient. The waves are observed propagating in the direction of the ion drift at a speed approximately 6 cm/s. In the experiments under microgravity conditions (performed on board the ISS in Ne at a pressure of 16 Pa with MF microparticles of 9.2 μm diameter) intense induced oscillations and nonlinear waves are studied. Without excitation a weak global breathing mode and weak horizontal waves (approximately with the same frequency) are observed. Increasing the modulation frequency widens the spectrum. The modulation first excites a global slashing mode (at the modulation frequency) then intense nonlinear wave-ridges appear in the cloud. The ridges travel at an approximately constant speed 4-7 mm/s. The wave frequency, phase velocity, and wavelength are measured, and particle migrations affected by the waves are analyzed.