

Nonlinear modes of oscillations of two dust particles

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In laboratory experiments, micrometer-sized highly-charged dust particles can be levitated in the sheath region of a horizontal negatively biased electrode due to the balance between gravitational and electrostatic forces acting in the vertical direction. Variable charges on the particle and plasma wake potential can also impose an influence in the vertical structure of the particles. Although some are complicated, these processes can affect the dust particle motion and introduce various nonlinear phenomena such as oscillations, disruptions and instabilities of particles [1,2].

Here, the nonlinear effects in the oscillations of two dust particles levitating in vertical and horizontal confining potentials were investigated. Different cases corresponding to various relations between the oscillation amplitudes were considered. The nonlinear coupling between the horizontal and vertical motions of dust particles was studied. Theoretical treatment was accomplished for argon RF discharge in which the experiments of oscillation modes in the system of two dust particles was observed and analyzed. In particular, specific shapes of confining potential were applied to elucidate the characteristics of nonlinear motions of the particles.

Our model can serve as a basis for further investigation of nonlinear phenomena in structures consisting of larger number of particles, e.g., solitons formation in chains of dust particles.

[1] S.V. Vladimirov and A.A. Samarian, Phys. Rev. **65**, 046416 (2002)

[2] A.A. Samarian, S.V. Vladimirov, and B.W. James, Phys. Plasmas **12** (2005), in press.