The effect of the dust’s electric dipole moment on transverse oscillations of the one dimensional dusty crystals

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Abstract
In this paper, we investigated the effect of dipole-dipole interaction between the dust particles on the transverse oscillation of one dimensional dusty crystal. We used the Boltzmann distribution for the electrons and ions density and assumed that dust particles are negatively charged. The equation of motion for dust particles in this one dimensional chain was obtained. It is shown that the direction of dipoles plays an important role in the motion of dusts and significantly changes the oscillation frequency. Also, in the long wavelength approximation, a nonlinear Schrödinger equation for the evolution of the amplitude of the nonlinear oscillations was derived, showing that both the bright solitons and the dark solitons could exist.

Keywords: dusty plasma crystal, stability domain, envelope soliton

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