

Nonlinear vertical oscillations of a single dust particle in a stratified glow discharge.

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The nonlinear forced oscillations of a single dust particle trapped in a standing striation are investigated. The method of the discharge current modulation [1] is used to obtain the multi-resonance curves at pressures $p=0.06$ and $p=0.16$ torr. The frequency responses are investigated depending on value of the modulation depth. In this paper the parametric instabilities, which were previously observed under the conditions of rf discharge in papers [2,3], are investigated under in dc plasma. The amplitude-dependent frequency shift of resonance peaks, which is associated with values of the amplitude of the driving force, is experimentally obtained. The detailed measurements of the amplitude-frequency characteristic near resonances at the fundamental and doubled frequencies make it possible to detect the vibrational hysteresis.

The theory of the anharmonic oscillator provides a good quantitative description of the experimental data. The value of the eigenfrequency is determined and the obtained value is compared with the value experimentally obtained in the similar conditions of the dc glow discharge in [4]. The values of the thresholds of excitation of parametric instabilities, the anharmonic coefficients and the critical values of the oscillation amplitude for the hysteresis were calculated.

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