ELECTRIC EXTERNAL INFLUENCE ON THE MOTION OF A CHARGED PARTICLE IN A LINEAR ELECTRODYNAMIC TRAP AT THE STABILITY BOUNDARY

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We succeeded in calculating two-dimensional trajectories of a charged particle in a horizontal linear electrodynamic trap in air at atmospheric pressure for several cases—stable motion inside the trap, flight of the particle under the action of electrodynamic forces of the trap and falling out of the particle under the action of gravity. The calculation result was also reproduced experimentally for the following parameters.

The diameter and length of the linear electrodes of the trap are 4 mm and 300 mm, respectively, and the distance between the centers of the electrodes is 19 mm. The calculations were performed for aluminum oxide particles (density 3.99 g/cm^3) in the ideal sphere approximation. The particle diameter and mass at stable motion inside the trap are 20 Î¼m and $1.65 \cdot 10^{-8}$ g respectively. The charge is $9.8 \cdot 10$ charges of the electron e. The amplitude value of the AC voltage on the electrodes was taken as 5 kV, the frequency as 50 Hz, because this is the condition the particle was held in the trap during the experiments. During the calculations, the charged particle was placed in the center of the trap at the initial moment of time, the initial velocity of the particle was set to zero.

Well known is the system of a simple rigid pendulum with oscillating suspension, the so-called Kapitza pendulum. It is interesting to apply the phenomenon of parametric resonance to a particle in a trap by external electrical influences as a dynamical stabilization. In order to do this, a horizontal trap is proposed to be placed between two flat electrodes. The alternating voltage with an amplitude of 3 kV on the upper electrode has the form of a meander. The lower electrode is grounded.

In this paper we report the behavior of charged particles at the stability boundaries when they are subjected to an external alternating electric field.