Theoretical investigation of attraction of electric probes in isothermal low-temperature plasma

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Numerical calculations of energy of interaction of two electric probes in isothermal plasma have been executed using MathCad system. The opportunity of an attraction of two electric probes of radius $r_0 << R_d$ (where R_d - Debye radius) has been investigated in wide borders. The basic formulas describing the concentration of charged particles and the potential profile around probes have been taken from [1]. The method of calculation of energy of interaction (U) was similar to used in [2].

Almost all values of potentials of probes have been captured during the calculations: from values: $10^{-3}\frac{\chi T}{e}$ up to $10^{-3}\frac{\chi T}{e}$. In accordance with [1], four zones of values of potential have been allocated: $\varphi_0 \ll 1$, $\varphi_0 < \frac{R_d}{r_0}$, $\varphi_0 \gg \frac{R_d}{r_0}$ and $\varphi_0 \gg 1$. Each zone is described by the independent set of the equations. The behaviour of concentration of the charged particles around the probes for the third zone is not studied yet, but can be asymptotically presented. During calculations the temperature was varied in a range of $T = 600 - 1000K$, the size of probes was varied from values 0.02 till 0.06 and the concentration of charged particles from 10^6 ñì$^{-3}$ up to 10^8 ñì$^{-3}$. The result of calculations is presented in figure 1. for values of temperature - 600K, probes radius - $r_0 - 0.05R_d$ and concentration $n_0 - 10^6$ ñì$^{-3}$.

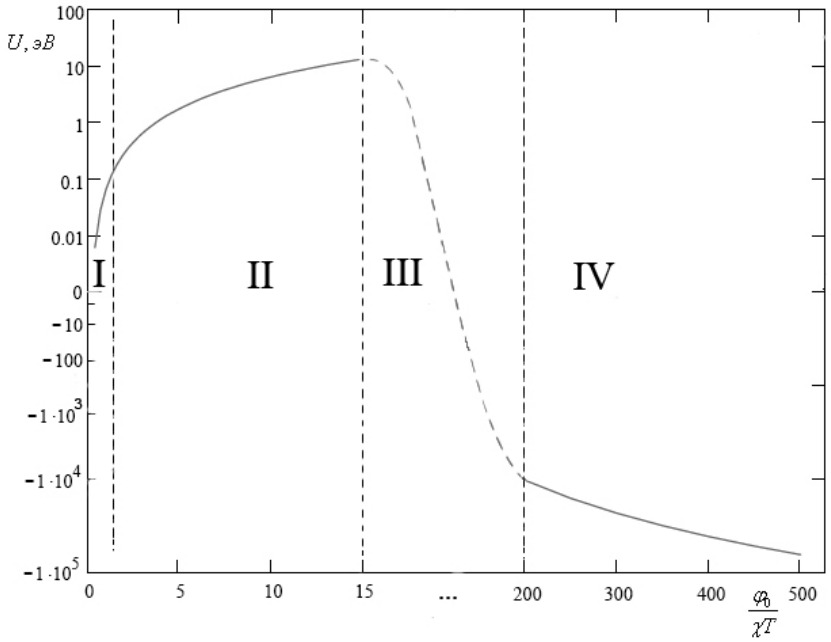

Рис.1

1 Pitaevsky L.P, Alpert Y.L., Gurevich A.V.. Satellites in low-density plasma. 1964 p. 337-349
2. Gerasimov D.N., Sinkevich O.A.. Formation of Ordered Structures in Thermal Dusty Plasma // High Temperature.– 1999 T.37 №6. p.853-857.