THERMAL PROPERTIES OF NON-IDEAL YUKAWA SYSTEMS

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The approximation for energy density for *2D*-system is written:

$$U = U_0 + T + 4\varepsilon_f \Big/ \left[1 + \exp\left(\varepsilon_f / T\right)\right], \tag{1}$$

where $\varepsilon_f / T = 1/2 + \Gamma^* / \Gamma_h^*$. The heat capacity C_V might be calculated via two approaches shown below:

$$C_V = \left(\partial U / \partial T\right)_V, \tag{2}$$

$$C_V = T^2 / \delta T^2 . \tag{3}$$

The values U and δT can be obtained from solution of the system of electrodynamics equations along with the equation of motion accounting the stochastic force $\tilde{\vec{F}}$, $\left\langle \tilde{\vec{F}} \right\rangle = 0$, $\left\langle \tilde{\vec{F}}(0) \cdot \tilde{\vec{F}}(t) \right\rangle = 4TM\nu_{fr}\delta(t)$ [1, 2].

Assuming that the effective frequency ω^* of charged particle collisions is independent of temperature T, the solution of mentioned above system of equations yield for U и δT the following:

$$U = U_0 - T_c + 3T - 2\left(\nu_{fr} + \omega^*\right) D, \tag{4}$$

$$\delta T^2 = 0.4T^2 + 0.4\left(\nu_{fr} + \omega^*\right) DT, \tag{5}$$

where D is diffusion constant, T_c – temperature value at $\Gamma^* = \Gamma_c^* \approx 153$ [3]. Under condition $\left|\phi'(l_p)\right| \cdot l_p \Big/ \left|\phi(l_p)\right| < 2\pi$ the value of $\omega^* = \sqrt{\phi'' / l_p^3 \pi M}$ [2, 5].

In this paper the following dependencies on Γ^* are obtained: $D^* = D\left(\nu_{fr} + \omega^*\right) M / T$, $\left(U - U_0 - T\right)/T$.

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Литература

1. *Vaulina O. S.* [*et al.*]. Evolution of the mass-transfer processes in nonideal dissipative systems. I. Numerical simulation. // Physical Review E. – 2008. – V. 77. – N. 066403, 066404.

2. *Vaulina O. S.* [*et al.*]. Determination of the pairwise interaction potential between dust grains in plasma // Plasma Physics Reports. – 2007. – V. 33. – P. 278–288.

3. *Vaulina O. S.* [*et al.*]. Two-Stage Melting in Quasi-Two-Dimensional Dissipative Yukawa Systems // Phys. Rev. Lett. – 2006. – V. 97. – N. 195001.