OSCILLATIONS OF THE INERTIA MOMENT OF A FINITE FERMI SYSTEM IN THE CRANKING MODEL FRAMEWORK

Khamzin A.[1], Nikitin A.S.[2], Sitdikov A.S.[2]
[1]*Kazan (Volga Region) Federal University, Institute of Physics, Russia;*
[2]*Kazan State Power-Engineering University, Russia*
E-mail: airat.khamzin@rambler.ru

In this work we present new analytical method for calculating the dependence of the moment of inertia of a heated finite nucleonic system on the chemical potential in the framework of the cranking model. In our calculations we use the standard Mellin transformation method, which allows us to split the moment of inertia into two components, smooth and oscillating. Obtained explicit analytic expressions for these components, which hold in the entire interval of temperatures and deformation parameters, allow us to study (without numerical computations) important pecularities of the dependences of the moment of inertia on the number of particles, temperature, and deformation. In particular, we showed that the oscillations of the moment of inertia increase depending on the chemical potential at spherical limit $\omega_{x,y} \to \omega_z$ and decrease rapidly as the temperature increase.

We also calculate the rigid-body moment of inertia that is realized when the condition of statistically equilibrium rotation holds. It is also shown that the oscillations dependent on the chemical potential are also involved in this case. However, the oscillations for the rigid-body moment of inertia are manifested to be weaker and do not disappear in the spherical limit at zero temperature. The method of splitting physical quantities into smooth and oscillating components developed in this work can be also applied to other systems in which complicated nonmonotonic behavior of physical characteristics is caused by the boundedness of the system geometry or the motion of particles.