Temperature-abnormal diffusion in tilted periodical potentials

I.G. Marchenko[a,b,d], I.I. Marchenko[c]and and V.I. Tkachenko[a,b]

[a] *NSC Kharkov Institute of Physics and Technology , 1 Akademicheskaya str., Kharkiv 61108, Ukraine,*

[b] *Kharkov National University, 4 Svobody Sq., Kharkiv 61022, Ukraine*

[c] *NTU Kharkov Polytechnic Institute, 2 Kirpicheva St., Kharkiv 61002, Ukraine*

[d] *E–mail: march@kipt.kharkov.ua*

The phenomena of diffusion play a key role in a number of processes in physics, chemistry and biology. Our intuitive notion of the diffusion tells us that diffusion processes pick up speed with an increase in temperature. Meanwhile, this statement is unfair for the systems that are far from equilibrium. In this talk the systems with a different level of friction have been investigated. A set of original theoretical results on diffusion enhancement of underdamped Brownian particles in tilted space-periodic potential is presented [1-4]. It was established that the systems with a low friction level γ‘ show temperature abnormal diffusion (TAD) at which the diffusion coefficient D is increased with a decrease in temperature. This talk studies how the transition from the exponential relationship of TAD to the ordinary power temperature relationship occurs with an increase in γ‘. It was shown that the energy barrier ε separating running and localized solutions is decreased with an increase in the friction coefficient At γ‘ > 1.1 the value of ε is close to zero.

It was established that the temperature window of TAD appears in the domain of the intermediate values of friction coefficient $0.1 < \gamma$‘ $<$ 1.1. In a certain range of forces the diffusion coefficient is first increased with a drop in temperature and then it drops again. The diagrams of the existence of such domains were constructed.

The obtained data open the prospects for the creation of new technologies used for the control of diffusion processes.

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