Anomalous kinetic heating of microparticles in plasma with a decrease in the temperature of the buffer gas

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An experimentally observed feature of plasma-dust systems is the significantly higher kinetic energy of particles compared to the temperatures of all components of the surrounding nonequilibrium medium. Using the example of two interacting microparticles in a gas-discharge plasma, the mechanisms of anomalous kinetic heating of particles at different temperatures of the buffer gas were experimentally studied using the method of spectral response to stochastic processes [1]. Analysis of experimental data using the developed theoretical model showed that at room temperature (290 K) the dominant mechanism of kinetic heating of microparticles in gas-discharge plasma is the work of non-potential forces associated with the wake induced by microparticles. However, in the plasma of ultracold gas (1.93 K), the dominant source of kinetic heating of microparticles becomes the random processes affecting them. Moreover, if at room temperature the intensity of random processes acting on particles corresponds to the temperature of the heat source, which is close in value to the temperature of the buffer gas, then when the gas temperature decreases by two orders of magnitude, the temperature of the heat source increases by an order of magnitude.

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