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Phase Transitions in Quasi-2D Plasma-Dust Systems: Simulations and Experiments[1] OLEG PETROV, MIKHAIL VASILIEV, KONSTANTIN STATSENKO, XENIYA KOSS, ELENA VASILIEVA, MAXIM MYASNIKOV, EVGENY LISIN, Joint Institute for High Temperatures RAS, Moscow, Russia — A nature of phase transition in quasi-2D dusty plasma structures was studied and the influence of the quasi-2D cluster size (a number of particles in it) on the features of the phase transition was investigated. Experiments and numerical simulation was conducted for the systems consisting of small (~ 10) and large ($\sim 10^3$) number of particles. To investigate the phase state of the system with 7, 18 and 100 particles observed in numerical and laboratory experiments, we used the method based on analysis of dynamic entropy. Numerical modeling of small systems was conducted by the Langevin molecular dynamic method with the Langevin force, responsible for the stochastic nature of the motion of particles with a given kinetic temperature. Phase state of systems with the number of elements in the order of 10^3, was studied using the methods of statistical thermodynamics. Here we present new results of an experimental study of the change of translational and orientational order and topological defects, and the pair interactions at 2D melting of dust cluster in rf discharge plasma. The experimental results have revealed the existence of hexatic phase as well as solid-to-hexatic phase and hexatic-to-liquid transitions.

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