EVOLUTION OF ACTIVE BROWNIAN MOTION OF CHARGED GRAINS IN STRONGLY COUPLED DUSTY PLASMA

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The charged dust represent a non-neutral or quasi-neutral systems (dusty plasmas) containing micron-sized particles (dust or grains) of a substance with electrical charges up to 10^2-10^5e. As a result of strong interaction of the strongly charged dust particles they may form the ordered structures of liquid and crystal types that are different from gas-like or chaotic systems.

Most of the laboratory studies of dusty plasmas are carried out in weakly ionized gas discharge plasmas. As a result, the laboratory dusty plasma is the unique object for studying the structure, phase transitions and transport properties of the systems of interacting grains on the “kinetic level”.

Dust system is affected by gravity, depending on the size of the solid particles gravity can be the dominating force. Under microgravity conditions in space much weaker forces become important and other new phenomena not achievable on Earth can be observed. In this report results are presented from the experimental studies of charged dust systems under ground bounded and microgravity conditions.

We study Brownian motion of a metal coated grains, suspended in RF gas discharge, under laser irradiation. The motion is caused by photophoresis: i.e., absorption of a laser at the metal-coated surface of the particle creates radiometric force which in turn drives the particle. The grains gain sufficiently high electrical charge (~10^2-10^5 of electron charge) under the flows of plasma particles or in the emission processes. The action of external forces and forces of interparticle interaction combined with dissipative mechanisms in these systems can lead to the self-organization of the system, resulting in formation of quasi-stationary crystal- or liquid-like structures. We observed experimentally the active Brownian motion (irregular or directed) caused by radiometric force at different Coulomb coupling of the charged grains.