Evolution of a quasi-two-dimensional system of charged active Brownian motors in a HF discharge plasma

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The study of active Brownian motor systems in colloidal plasma is especially interesting, as their dynamics change significantly in plasma as a result of strong interactions between them. A key feature of such systems is their ability to maintain a local energy balance, providing continuity of internal processes through the supply of energy from external sources [1]. Under thermodynamic non-equilibrium conditions, such systems can maintain ordered states with entropy lower than the equilibrium value through the constant dissipation of energy into the environment [2]. The connection between local energy flows and the global evolution of a system of active Brownian motors is based on a mechanism of dissipative self-organisation, which can be used to control the state of such complex systems.

An experiment to investigate the evolution of active Brownian motor system was carried out in a high-frequency discharge plasma with varying laser intensity. The initial system consisted of a quasi-two-dimensional, ordered, densely packed structure, similar to hexagonal structure. As the laser intensity increased, the motors in system began to move actively, disrupting the order in the structure and leaving it. It was found that as state of the system changed, the average kinetic energy of motors also changed. For each intensity value, system transitioned to new state, characterised by both specific dynamics (kinetic energy, mean square displacement) and structural characteristics (particle concentration, interparticle distance).

[1] Fortov V E, Khrapak A G, Khrapak S A, Molotkov V I and Petrov O F 2004 *Physics-Uspekhi* **47**(5) 447–492

[2] Prigogine I, Nicolis G and Babloyantz A 1972 *Physics Today* **25**(11) 23–28