Structures of active Brownian particles in a monolayer of colloidal plasma under laser irradiation

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This work presents experimental results on structural transitions in a monolayer of active Brownian particles. The experiments were conducted using synthesized melamine-formaldehyde (MF) particles confined in a radio-frequency (RF) plasma discharge. The particles were coated with a light-absorbing layer via magnetron sputtering, enabling localized heating under laser irradiation and thereby increasing their kinetic energy of motion. A transition from an ordered to a disordered state was observed in a system far from thermodynamic equilibrium, proceeding through an intermediate hexatic state [1]. The analysis of this transition employed pair correlation functions, bond-angular correlation functions, the two-dimensional static structure factor, and a characterization of topological defects. The findings indicate a two-stage melting scenario consistent with the Berezinskii–Kosterlitz–Thouless (BKT) theory [2] for two-dimensional systems in thermodynamic equilibrium. This work was supported by the Russian Science Foundation (Project No. 25-12-00406).

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[2] M K J and J T D 1973 *J. Phys. C: Solid State Phys.* **6**