Variation of character of motion in a sphere-like system of active Brownian particles under laser radiation

Senoshenko R V[1,2,@], Kononov E A[1], Vasiliev M M[1] and Petrov O F[1]

[1] Joint Institute for High Temperatures of the Russian Academy of Sciences, Izhorskaya 13 Bldg 2, Moscow 125412, Russia
[2] Moscow Institute of Physics and Technology, Institutskiy Pereulok 9, Dolgoprudny, Moscow Region 141701, Russia

[@] senoshenko@mail.ru

Active particles, able to convert external energy into their own directed motion, can form various systems [1]. Such formations can be observed in colloidal systems—dispersed particles distributed in continuous media. Active colloidal particles are able to self-organize and show collective phenomena [2]. This phenomena can be observed in vortex motion. It can be seen both in living systems and in artificial active colloidal systems [3]. It was experimentally observed that the character of motion changes from directed to vortex in a sphere-like system of active Brownian particles. The system was a surface-stabilized melamine-formaldehyde particles with partial copper coating in a viscous liquid media. The system contained more than 3000 particles and was fully exposed to laser radiation. Initially, the particles moved unidirectionally along closed circular trajectories. During exposure, their character of motion changed to vortex motion, with the particle system separating into two multidirectional vortices. The coordinates of particles were obtained, trajectories were reconstructed. Their velocities and kinetic energies were calculated and distributions were plotted. Time dependences of mean squared displacement were plotted and diffusion coefficients were calculated. The study was funded by the Russian Science Foundation (project No. 20-12-00372).

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