Inertial and inertialess motion of an active Brownian particle in the stratum of a glow direct-current discharge

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Active Brownian motion in a viscous (in particular, liquid) medium is inertialess (significantly overdamped). However, when viscosity of medium decreases or rotational diffusion enhances (due to internal active processes or external action), inertial effects can dramatically change character of particles motion. Suitable conditions can be realized for light-absorbing particles in weakly ionized plasma [1], which can make it possible to observe transition from an overdamped mode of motion to an underdamped one. Such experimental studies make it possible to control dissipation in wide range, unachievable for active systems in liquid [2]. The features of three-dimensional dynamics of an inhomogeneously light-absorbing particle levitating in discharge at various laser intensity and viscosity of surrounding medium have been experimentally investigated. To determine the motion regime of an active particle, the trajectories and oscillation spectra at different medium and irradiation parameters were obtained, mean squared displacment, velocities, and average kinetic energies, as well as gradients of the stratum electric field in the levitation region of the particle were calculated. The study was funded by the Russian Science Foundation (project No. 24-22-00130).

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[2] Lisin E A *et al* 2021 *Phys. Chem. Chem. Phys.* **23** 16248–16257