Dynamic properties of a single active Brownian particle in near electrode layer HF discharge

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The dynamics and self-organization of active colloids are currently a focus of attention for many researchers worldwide. Active colloidal particles can convert environmental energy into motion. The combination of collective interactions among them and positive energy flow from the environment enables active systems to exhibit complex behavior and self-organization [1–3], similar to living organisms.

We present results of an experiment on a single active Brownian particle in RF discharge. The active particles used in the study were calibrated plastic spheres with a diameter of 11.56 μm, partially coated with molybdenum. When the particle is illuminated by a laser, a radiometric force occurs [4], whose direction changes stochastically due to rotational diffusion. The laser power in the experiment varied from 50 mW to 1500 mW.

For each case, the particle's trajectory, kinetic energy, mean squared displacement, and chirality parameter (average sign of the sine of the angle between the particle's velocities at consecutive trajectory points) were obtained. The dependencies of these parameters on laser power were investigated.

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