FRACTAL DIMENSION OF THE TRAJECTORY AND LOCALIZATION AREA OF A COLLOIDAL PARTICLE IN PLASMAS: NUMERICAL SIMULATION

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Entropy and other tools used within the frames of physics of the dissipative systems are universal and can be successfully applied to study the evolution of active Brownian systems [1]. This work is devoted to investigate the approach proposed in [2]: the computation of the mean first-passage time dynamic entropy (MFPT entropy). With the help of this approach, it is possible to describe the motion of each individual (active or passive) Brownian particle using several parameters (such as the fractal dimension of its trajectory and the size of its localization area), and to compare different modes of motion [3].

Numerical simulations of the dynamics of a single colloidal particle was carried out using different models of motion: Brownian, Langevin, and active motion of the colloidal particle were considered. The self-propelled velocity of the particle, the rotational diffusion coefficient, the ratio of the friction coefficient and the time step ("camera frequency") were varied; simulation was carried out of a particle on an infinite plane and in a parabolic trap. For each case studied, the dependences of the mean-square displacement on time and the MFPT dynamic entropy on the coarsening parameter were obtained. Statistical distributions of the fractal dimension of the particle trajectories and its localization area as a function of the particle trajectory length are investigated. Comparison with the existing theoretical models is carried out.

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