Experimental study of the spectral characteristics of stochastic motion in chain structures of microparticles in a dc gas discharge

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This work presents a new experimental method based on the analysis of the spectral density of random processes, which makes it possible to study nonreciprocal effective forces of interaction between particles in nonequilibrium media. Unlike previous studies, this method does not require special modernization of the experimental setup, external disturbances of the system, preliminary measurements of external fields, or any assumptions regarding the type of interaction. The proposed method was used to recover the derivatives of the forces of interparticle interaction and the external electric field, as well as dissipative forces acting on particles in quasi-one-dimensional dissipative chain systems, by solving the inverse problem of the spectral density of random processes acting in the analyzed system. Approximation of the experimentally measured spectral densities using analytical equations made it possible to determine the derivatives of specific interaction forces and specific external electromagnetic forces. In the entire range of discharge parameters, the effective interaction between particles was nonreciprocal.
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