Dynamics of electric dipoles in fluctuating random electromagnetic fields.

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Abstract

In this work, we analyze the dynamics of single and coupled electric dipoles in a light field consisting on electromagnetic plane waves with polarizations randomly distributed and fluctuating phases.

For the particular case of an isolated dipole, the expressions for the optical random force fluctuations, the optical drag force, the equilibrium kinetic energy and the diffusion constant are derived [1]. Numerical simulations for the dynamics of a resonant dipole, initially at rest, show a crossover between super diffusive and diffusive regimens (see Figure 1).

For the case of two dipolar particles in a random electromagnetic field an isotropic interaction between the two particles emerges [2,3,4]. The value of the interaction strongly depends on fields and particle's properties [5] and, for some particular situations, gravitational like dynamics with interactions showing a $1/r^2$ dependence are expected [2,3,4].

References

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Figures

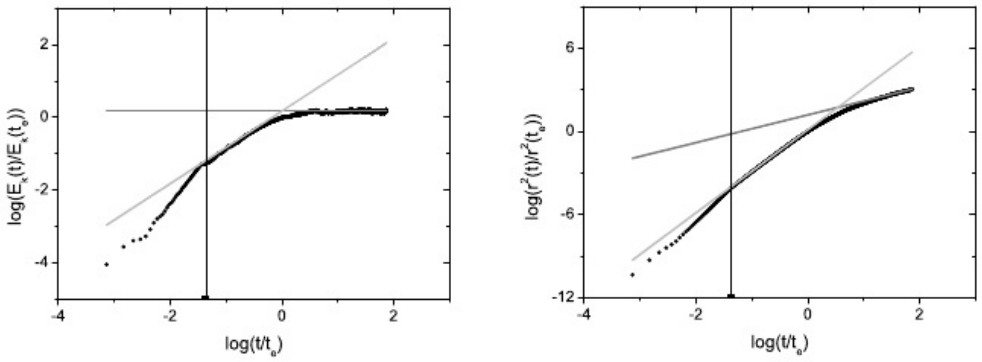

Figure 1: Log-Log plot of the molecular dynamics simulation results for the mean kinetic energy and the mean square displacement of a resonant electric dipole in a fluctuating random field (black dots). The dark gray line is the expected diffusive behavior. The gray line is the expected super diffusive behavior.