One-particle correlation function in Evanescent Wave Dynamic Light Scattering

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In Evanescent Wave Dynamic Light Scattering (EWDLS) experiments in colloidal suspensions one measures the scattered electric field time correlation function, which is connected to diffusive properties of the system. This technique allows to probe areas close to an interface but also introduces exponentially decaying illumination profile. The resulting decay of the correlation function stems from an interplay between the nonuniform illumination and hydrodynamic interactions with a planar surface.

Theoretical predictions are crucial for the interpretation of new experimental data [1,2]. We consider a dilute system, where effectively we have a one-particle problem. Hydrodynamic interactions with a surface result in strong modification of particles mobility when approaching the wall. We describe the effect of this change on the dynamics and relate it to the electric field correlation function decay. We identify the influence of the penetration depth and the scattering vector on the decay rate and compare it to a case with no hydrodynamic interactions, when the problem can be solved analytically [3].

Inclusion of hydrodynamic interactions was achieved by employing a Brownian Dynamics simulation with a very precise numerical implementation of mobility matrix elements [4], which allows us to predict the shape of the electric field correlation function for given values of experimental parameters. We compare the results with recent experimental developments.

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