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Translational and rotational Brownian motion of particles of complex shapes

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The characteristic time scales of the translational and rotational Brownian diffusion for nanoparticles are typically much smaller than time resolution of the experiments. In this case, nanoparticles can be treated as point-like, and described by the standard Brownian theory. However, for microparticles, the characteristic Brownian time scales are of the order of seconds, and therefore non-negligible in comparison to the typical time scales of the measured Brownian motion. For microparticles of complex shapes, a more general theoretical approach is needed. The exact analytical expressions for the time-dependent cross-correlations of the translational and rotational Brownian displacements of a particle with arbitrary shape have been recently derived [1,2], and it has been demonstrated how to benefit from these results while analyzing experimental data [3].

[1] Cichocki B., Ekiel-Jeżewska M. L., Wajnryb E., J. Chem. Phys. 142, 214902, 2015.

[2] Cichocki B., Ekiel-Jeżewska M. L., Wajnryb E., J. Chem. Phys. 144, 076101, 2016.

[3] Cichocki B., Ekiel-Jeżewska M. L., Wajnryb E., Arch. Mech. 69, 1. 2017.

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