Confined Brownian Motion of Soft Colloids

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Confined motions are ubiquitous in microbiology. Examples at the micro- and nano-scales include durotaxis of stem cells, blood cells flowing in vessels, antibody recognition, or motion of synaptic receptors. These situations contain soft objects coupled to viscous flows and confining boundaries, in presence of and thermal fluctuations.

Aiming at unravelling the link between softness and thermal - *i.e.* Brownian - motion, a novel method based on holographic microscopy and a statistical inference algorithm [1] is used. The technique allows for a precise experimental characterization of the 3-dimensional motion of a single free Brownian spherical colloid diffusing in a viscous liquid near a charged rigid glass wall.

Already in the case of a micrometric rigid polystyrene sphere, striking differences compared to bulk Brownian motion are measured and quantified. Namely, the statistics of displacements deviates from Gaussian distributions, which is quantified through high-order cumulants [2]. Also, femtonewton-resolved surface forces, which include electrostatics repulsion and weight, are extracted from Brownian trajectories.

The case of a deformable micro-sphere is even more puzzling. Specifically, we study the confined Brownian motion of a low-surface-tension viscous oil droplet. Note that the emergence of non-conservative visco-capillary forces is established for deterministic systems [3]. However, maybe surprisingly, experiments are currently indicating that such mechanisms also affect thermally fluctuating systems.

Keywords: *Brownian motion - Soft confinement - Holography - Non-Gaussian processes*

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