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Microscopic transport in complex environments

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Diffusion is a fundamental transport mechanism governing the spreading of microscopic entities. This phenomenon can be enhanced by orders of magnitude in the presence of hydrodynamic velocity gradients due to the Brownian motion across streamlines –a process commonly known as the Taylor dispersion. This phenomenon notably plays a major role in chemical reactions in porous media and engineering of microfluidic devices. Furthermore, the transport is also determined by the confining boundaries. The transported objects can experience electrostatic and hydrodynamic interactions with the boundaries, or even reaction/adsorption at these interfaces. Here by using evanescent wave microscopy, already used to measure the Taylor dispersion full dynamics [1], we study the transport of charged nanoparticles in linear shear flows, near a charged, planar surface on one side, and an open, particle-consuming boundary on the other side. By varying the concentration of electrolytes, we show how the electrostatic repulsion from the surface reduces the dispersion. Besides, the open boundary equivalent to an adsorption-like condition induces an exponential decay of the particle number and a large decrease of the dispersion coefficient [2]. Our results thus bring new insight to the important question: “how do the characteristics of a surface affect microscopic transport in confinement?”
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References

[1] Vilquin, A., Bertin, V., Soulard, P., Guyard, G., Raphaël, E., Restagno, F., … & McGraw, J. D. (2021). Time dependence of advection-diffusion coupling for nanoparticle ensembles. Physical Review Fluids, 6(6), 064201. https://doi.org/10.1103/PhysRevFluids.6.064201
[2] Vilquin, A., Bertin, V., Raphaël, E., Dean, D. S., Salez, T., & McGraw, J. D. (2023). Nanoparticle Taylor dispersion near charged surfaces with an open boundary. Physical Review Letters, 130(3), 038201. https://doi.org/10.1103/PhysRevLett.130.03820

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