Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Advection-diffusion coupling of nanoparticle ensembles from short to long times[1] ALEXANDRE VILQUIN, VINCENT BERTIN, PIERRE SOULARD, Gulliver, ESPCI Paris, GABRIEL GUYARD, LPS, Paris Saclay University, ELIE RAPHAEL, Gulliver, ESPCI Paris, FREDERIC RESTAGNO, LPS, Paris Saclay University, THOMAS SALEZ, LOMA, Bordeaux University, JOSHUA D. MCGRAW, Gulliver, ESPCI Paris, GULLIVER TEAM, LPS TEAM, LOMA TEAM — Colloid transport in nanoscale flows is important in wide range of applications from chemical separation to drug delivery. In these flows, the coupling between advection and Brownian diffusion leads to an enhanced particle dispersion by orders of magnitude. Using evanescent wave microscopy in a microchannel, we observe nanoparticle motion in a near-surface zone where the velocity gradients, and thus the dispersion, are the largest. Supported by a theoretical model and simulations based on overdamped Langevin dynamics, our experimental results provide the full dynamics of the particle dispersion from short to long times. In particular, we highlight how the initial distribution of particles affects the time dependence of the transient regime. These results are crucial in controlling the nanoconfined chemical reactions or dynamical adsorption.

[1]The authors benefitted from the financial support of CNRS, ESPCI Paris, the ANR under the ENCORE (ANR-15-CE06-005) and CoPinS (ANR- 452 19-CE06-0021) grants, and of the IPGG (Equipex ANR-10-EQPX-34 and Labex ANR-10-LABX-31), PSL Research Uniersity (Idex ANR-10-IDEX-0001-02).

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Date submitted: 03 Aug 2020 Electronic form version 1.4