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DNA transport and conformation in confined environments: novel separation mechanism using hydrodynamics and electrophoresis
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— Nanofluidics has gained popularity because it offered new solutions for single molecule manipulation and for the separation of biomolecules [1]. In addition to confinement, which enables to induce the elongation of DNA through steric repulsion, we recently showed that the degree of spreading of single molecules could be monitored by tuning the flow in nanochannels [2]. In this report we investigate the concomitant flow actuation with hydrodynamics and electrophoresis to transport DNA molecules in confined slit-like channels. We demonstrate that DNA size separation can be performed with no separation matrix, and we prove that our approach outperforms conventional separation methods, e.g. gel electrophoresis, in terms of separation performances, because we report power scaling dependence of up to -3 for the DNA mobility *vs.* size response. We also describe the physics of DNA migration by single molecule microscopy and provide a mechanistic model of the separation.

[1] Dorfman, *AIChE* 59, 346 (2013).
[2] He, *Macromolecules* 46, 6195 (2013).

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