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Electrophoretic ratcheting of spherical particles in a simple microfluidic device: making particles move against the direction of the net electric field HANYANG WANG, GARY SLATER[1], Univ of Ottawa, HENDRICK HAAN [2], UOIT — We examine the electrophoresis of spherical particles in microfluidic devices made of alternating wells and narrow channels a type of system previously used to separate DNA molecules. Using computer simulations, we first show why it should be possible to separate particles having the same free-solution mobility using these systems in DC fields. Interestingly, in some of the systems we studied, the mobility shows an inversion as the field intensity is increased: while small particles have higher mobilities at low fields, the situation is reversed at high fields with the larger particles then moving faster. The resulting nonlinearity allows us to use asymmetric AC electric fields to build a ratchet in which particles have a net size-dependent velocity in the presence of an unbiased (zero-mean) AC field. Exploiting the inversion mentioned above, we show how to build pulsed field sequences that make particles move against the net field (an example of negative mobility). Finally, we demonstrate that it is possible to use these pulsed fields to make particles of different sizes move in opposite directions even though their charge have the same sign. Potential uses of these idea are discussed.

[1]Gary is my supervisor in my Master program
[2]Hendrick was part of the Gary's research group, this report shares many ideas with his work before.

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