Abstract Title

Chiral separation in microflows

Symposium Track

Fundamental Modeling in Nanomechanics

Authors' names

P. Hänggi, *M. Kostur, M. Schindler, and P. Talkner*

Authors' affiliations

University of Augsburg, Dept. of Physics, Universitatsstr. 1, 86135 Augsburg

Abstract body

Almost all molecules that are of biological relevance possess a handedness or chirality: Like a single glove they do not coincide with their mirror image. This innocuously lookin asymmetry between chiral partners (or enantiomers), causes huge difference in their biological properties and functionality. For example, we humans can only digest one chiral form of sugars or of amino acids; the taste and smell of different enantiomers may drastically differ, and one partner may be beneficial while the other can be toxic.

Nature manages to synthesize only one particular chiral substance in enzymatic reactions; in contrast, chemical reactions in vitro often result in a fifty-fifty racemic mixtures of enantiomers. The separation then requires a second complicated chemical step. Therefore the separation of enantiomers presents a prominent challenge in molecular biology and belongs to the "Holy Grail" of organic chemistry.

Here, the authors of **[1]** suggest an intriguing, novel sorting scenario that is based on tiny differences between the forces that enantiomers sense in a microfluidic flow pattern. The key idea is that with an appropriately prepared microfluidic flow a right handed eddy acts differently on a left handed chiral particles than on its right handed partner, see Figure. The result is that different enantiomeres finally reside on different attractors in the fluid. Interestingly enough, however, the separation efficiency is enhanced by the presence of ubiquitous irregular, thermal Brownian motion which in turn shoves each of the two chiral species into their corresponding, most stable attractor. For suitable flow patterns these specific attractors are well separated in space so that the different enantiomers residing there can conveniently be selected out. This provides the desired sorting mechanism.

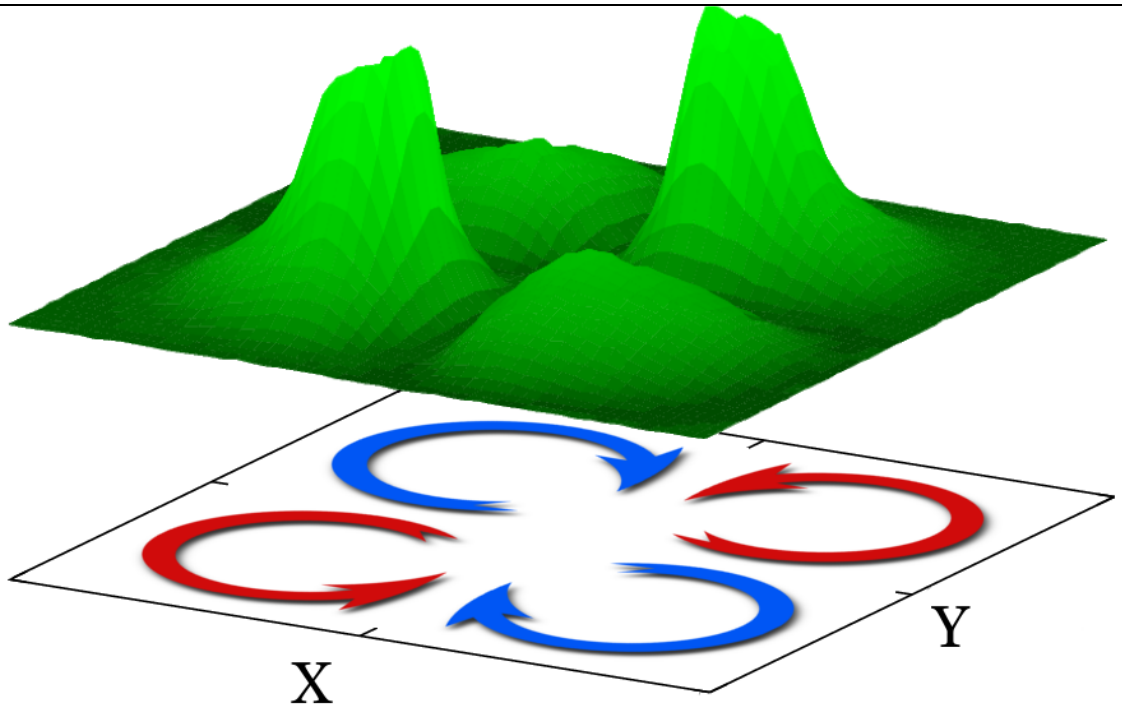

Figure: The (green) density of right handed particles is higher in right handed eddies (indicated by the red arrows) than in left handed eddies (blue).

Keywords

Nanofluidics, Brownian motors, Separation of Nano-Objects

References

[1] M. Kostur, M. Schindler, P. Talkner, and P. Hänggi, Chiral separation in microflows, *Phys. Rev. Lett.* **96**, 014502 (2006).

Corresponding author contact information

hanggi@physik.uni-augsburg.de