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Flow-controlled densification of E. Coli through a constriction
GASTÓN MIÑO, PMMH, UMR 7636 CNRS-ESPCI-Universités Paris 6 and 7, ERNESTO ALTSHULER, CARLOS PÉREZ-PENICHET, LENIN DEL RíO, Henri Poincare Group of Complex Systems and Superconductivity Laboratory, University of Havana, ANKE LINDNER, ANNIE ROUSSELET, ERIC CLEMÉNT, PMMH, UMR 7636 CNRS-ESPCI-Universités Paris 6 and 7 — Bacterial suspensions are examples of "active matter." Each bacteria can be regarded as a self-propelled particle that interacts hydrodynamically with its environment, including the surrounding "passive" fluid, the boundaries and other bacteria. In this presentation, we show a new phenomenon concerning E. Coli suspensions flowing through a funnel-like constrictions in micro-fluidic channels. The dynamics of bacterial suspensions flowing in confined spaces is relevant to understand their behavior in scenarios such as porous materials, soil, microbiology, water purification, and biomedical research. The applied flow induces a counter-intuitive symmetry breaking in the bulk bacteria concentration, which is found to increase past the funnel. The concentration enhancement persists over large distances and its amplitude increases linearly with the flow rate and disappears at large flow values. We show that the effect is reversible when the flow direction is reversed. We explain the observed effects on the interactions between the active bacteria and the channel boundaries. This experiment opens the possibility to control the concentration bacterial suspensions in microfluidic channels by simply tuning the flow of liquid.

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