Séminaire Général de Physique

E-coli bacteria in interaction with flows and boundaries

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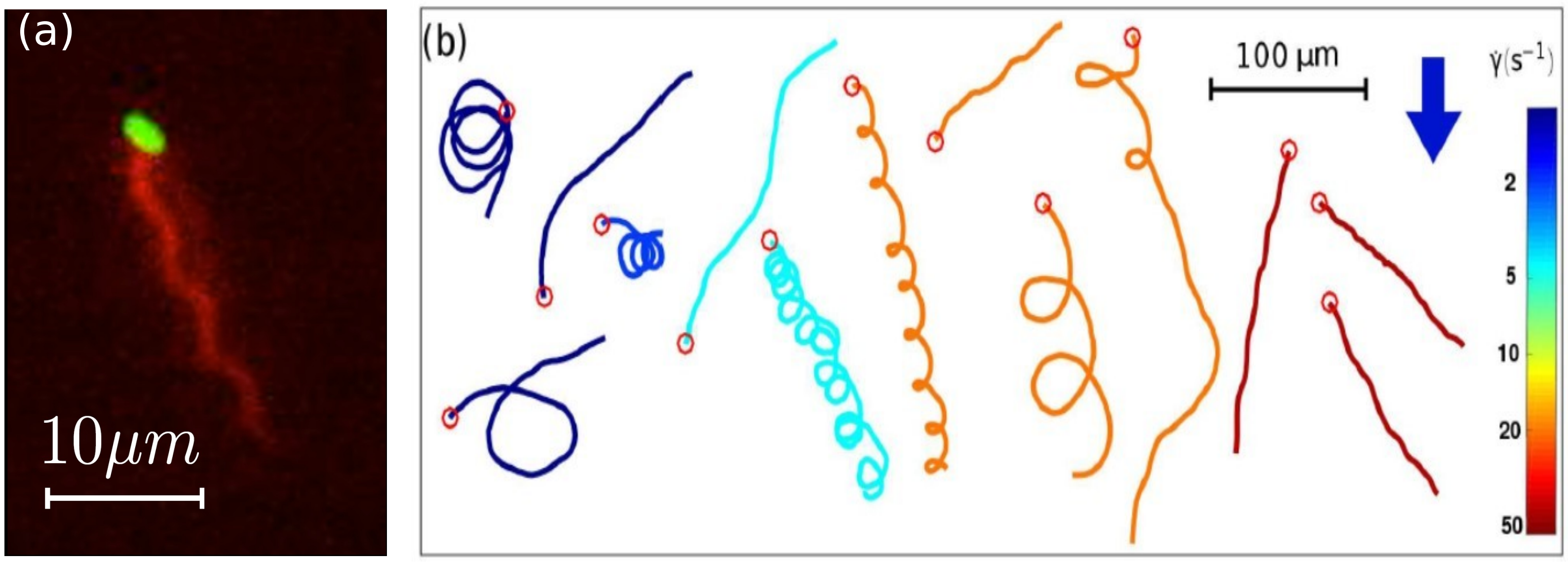
(café-croissants à partir de 9h40)

Active fluids consist of self-propelled particles (as bacteria or artificial microswimmers) and display properties that differ strongly from their passive counterparts. Unique physical phenomena, as enhanced Brownian diffusivity, viscosity reduction, active transport and mixing or the extraction of work from chaotic motion, result from the activity of the particles, locally injecting energy into the system. The presence of living and cooperative species may also induce collective motion and organization at the mesoscopic or macroscopic level impacting the constitutive relationships in the semi-dilute or dense regimes.

Individual bacteria transported in viscous flows, show complex interactions with flows and bounding surfaces resulting from their complex shape as well as their activity. Understanding these transport dynamics is crucial, as they impact soil contamination, transport in biological conducts or catheters, and constitute thus a serious health thread.

Here we investigate the trajectories of individual E-coli bacteria in confined geometries under flow, using microfluidic model systems in bulk flows as well as close to surfaces using a novel Lagrangian 3D tracking method. Combining experimental observations and modelling we elucidate the origin of upstream swimming, lateral drift or persistent transport along corners. The understanding gained can be used to design channel geometries to guide bacteria towards specific locations or to prevent upstream contamination.



(a) E-coli bacteria (G. Junot) (b) complex trajectories od E-coli bacteria under flow close to a surface (Mathijssen et al, submitted)

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