LadHyX Seminar – April 15, 11:00

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Rheotaxis and gravitaxis of artificial swimmers

Microorganisms have evolved to thrive in complex environments and to react to external signals such as flows, light or chemical gradients. Despite the internal complexity of the microorganisms their response to some signals, like shear flows or gravity, can be explained by simple mechanical arguments. In fact, it is possible to fabricate artificial micro-swimmers that perform rheotaxis or gravitaxis. In this seminar I will describe some experiments with phoretic particles swimming on inclined planes or under shear flows and I will show that rheotaxis and gravitaxis is strongly facilitated by interactions with solid boundaries, allowing even heavy microswimmers to climb nearly vertical surfaces or swim against strong flows.

To understand the experimental results we will use simple mathematical models and sophisticated simulations. In particular, I will introduce a robust and versatile numerical method to simulate active particles immersed on Stokes flows. Our method, well suited for many particles simulations of arbitrarily shaped colloids, is equivalent to a regularized Boundary Integral Method with the advantages that it can deal with Brownian noise and active flows easily.

