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Dynamics of bacterial suspensions

Bacteria swim in a bizarre way; they 'run and tumble' [1], Fig. 1. The ballistic regime, at short time, is linked to the straight propulsion of bacteria with its flagella and the diffusive regime, at long time is related to sporadic desynchronization of the flagella. Here, we will first validate "Differential Dynamic Microscopy" (DDM) [2], a new microscopy technique that allows the characterization of the dynamics of a large number of particles with Brownian dispersions of colloids and simple bacteria, E. Coli [3] and compare the results with particle tracking. Then we will structure bacteria dispersions so that the bacteria turn around pillars like electrons around atoms. Using the bacteria orbiting around a pillar we will study their orbit life time, the coupling of bacteria between pillars and the synchronization of the bacteria motion around coupled pillars.

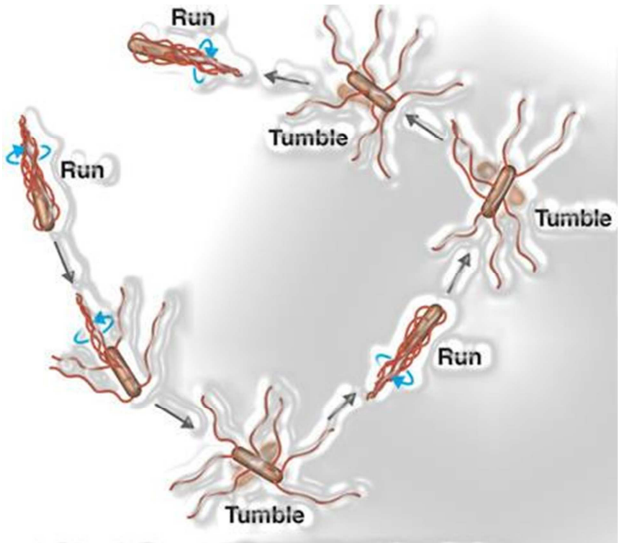

Fig. 1 Sketch of bacteria motility

Key words: active matter, bacteria, colloids, microscopy, 'differential dynamic microscopy', Brownian motion, phase separation, synchronisation. image analysis in matlab

PhD: I'm looking to recruit a PhD student on this project provided appropriate funding is found.

[1] Motile behavior of bacteria, H. C. Berg. *Physics Today* **53**, 24 (2000).
[2] Differential dynamic microscopy: Probing wavevector-dependent dynamics with a microscope. R. Cerbino, V. Trappe. *Phys. Rev. Lett.* **100**, 188102 (2008)
[3] Differential Dynamic Microscopy of Bacterial Motility. L. G. Wilson, V. A. Martinez, J. Schwarz-Linek, J. Tailleur, G. Bryant, P. N. Pusey, and W. C. K. Poon. *Phys. Rev. Lett.* **106**, 018101 (2011)