Thursday, Sept. 21 *at 10h45 :* ***Olivier Dauchot*** *(ESPCI)*

Model Experiments of Active Matter : at the interface between living organisms and theoretical models

The ubiquity of collective motions observed at all scales, in more or less complex situations, ranging from the cooperative action of molecular motors to the behavior of large animal or human groups, has driven a surge of scientific activity. Within physics, important theoretical progress was achieved by studying microscopic point-particles models [1-2] and their continuous descriptions [3-4]. Among the landmark results are the possibility of a true long-range polar ordered collective motion [1-4] as well as of a Motility Induced Phase Separation (MIPS) [5].

The robustness of these observations against the numerous factors integrated out in the above effective models is a matter of crucial importance towards a reliable description of living systems. The latter however often integrate too many source of complexity at once to allow for an immediate comparison.

This is where human-designed model experimental systems have a key role to play. Janus colloids, swimming droplets or walking grains are amazing experimental realization of self propelled particles. They are far more simple than their biological inspiration, and already contain important realistic factors, such as hydrodynamics effects and pairwise force interactions, which, at least in principle, can be controlled.

In the present talk, I will first briefly illustrate the above approach on the case of rolling colloids [6]. While this systems exhibit a remarkable transition to collective motion at very large scale; it also has a number of distinct features, which can only be explained by including the specificity of the hydrodynamics interaction. I will then turn to the case of walking grains [7,8]. In that case, I will discuss (i) how and why collective motion emerge in a system of polar disks, for which no alignment is a priori imposed at the microscopic level [9,10] and (ii) the decoupling of structure and dynamics observed in dense phases [11], for which little is known theoretically.

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