

DY 35: Plenary Talk M. Cates

Time: Wednesday 14:00–14:45

Location: HSZ 02

Plenary Talk

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The Statistical Mechanics of Active Matter — ●MICHAEL CATES
— DAMTP, University of Cambridge, Wilberforce Road, Cambridge
CB3 0WA, UK

In active matter, the local dynamics of individual particles is maintained far from equilibrium by a continuous conversion of fuel into motion. Examples include swimming bacteria and a class of synthetic colloidal swimmers in which a fuel bath and/or light field maintains self-propulsion. Such systems can show new forms of collective behaviour arising from the absence of microscopic Time Reversal Symmetry (TRS). An example is the motility-induced phase separation (MIPS) into dense and dilute phases for swimmers whose only interaction is a hard-core repulsion. (This contrasts with equilibrium sys-

tems which only phase-separate when attractions are present). In cases where swimming is light-activated, these collective effects might be exploitable in the directed assembly of swimming colloids into functional microfluidic devices.

I will discuss the above phenomena, and then describe how the physics of broken TRS can be incorporated into stochastic field theories of the Cahn-Hilliard type. An important question is whether the entropy production of individual particles survives coarse-graining, or whether it ceases to have any important effects at large length scales, so that the system is equivalent to an equilibrium one with shifted parameters (e.g., an effective attraction in the case of MIPS). This is a difficult question: I will describe some first steps towards answering it.