Pattern Formation and Effective Equilibrium Theories in Active Matter

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Active systems are defined as a new class of nonequilibrium systems consisting of interacting entities that individually dissipate energy to generate forces and motion and exhibit self-organized behavior at large scales.

Active particles can give rise to pattern formation and condensed phases with structural properties remarkably similar to those of ordinary materials. However, these phases are reached out-of-equilibrium in a regime where the machinery of equilibrium statistical mechanics cannot be applied anymore.

However, under some circumstances, the non-equilibrium dynamics of a collection of self-propelled particles can be recast into an effective equilibrium picture where the motility parameters play the role of external tunable thermodynamic parameters. This approach allows introducing a predictive theory in describing pattern formation in Active Matter.

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MPIDS, Prandtl lecture hall
Am Faßberg 11, Göttingen