Atelier
« Ordre partiel dans les matériaux : analyse, simulations et sujets connexes »
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Unexpected ordered phases in active matter systems

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Active matter describes systems whose constituent elements consume energy to generate motion. I will describe computer simulations of two recently developed active matter systems, and unexpected ordered phases that arise as a consequence of activity in these systems. (1) Self-propelled colloids with repulsive interactions and no aligning interactions are a minimal model active matter system. We and others have shown that this system undergoes athermal phase separation. Despite the intrinsically nonequilibrium nature of the phase transition, I will show that the kinetics can be described using a framework analogous to equilibrium classical nucleation theory, governed by an effective free energy of cluster formation, with identifiable bulk and surface terms. I will also show that when these particles are confined they undergo another transition, in which the particles become confined to the boundary, with a density that depends on the local curvature radius of the boundary. (2) Active nematics are liquid crystals which are driven out of equilibrium by energy-dissipating active stresses. The ordered nematic state is unstable to the proliferation of topological defects, which undergo birth, streaming dynamics, and annihilation to yield a seemingly chaotic dynamical steady-state. In this talk, I will show that order emerges from this chaos, in the form of heretofore unknown broken-symmetry phases in which the topological defects themselves undergo orientational ordering.

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