

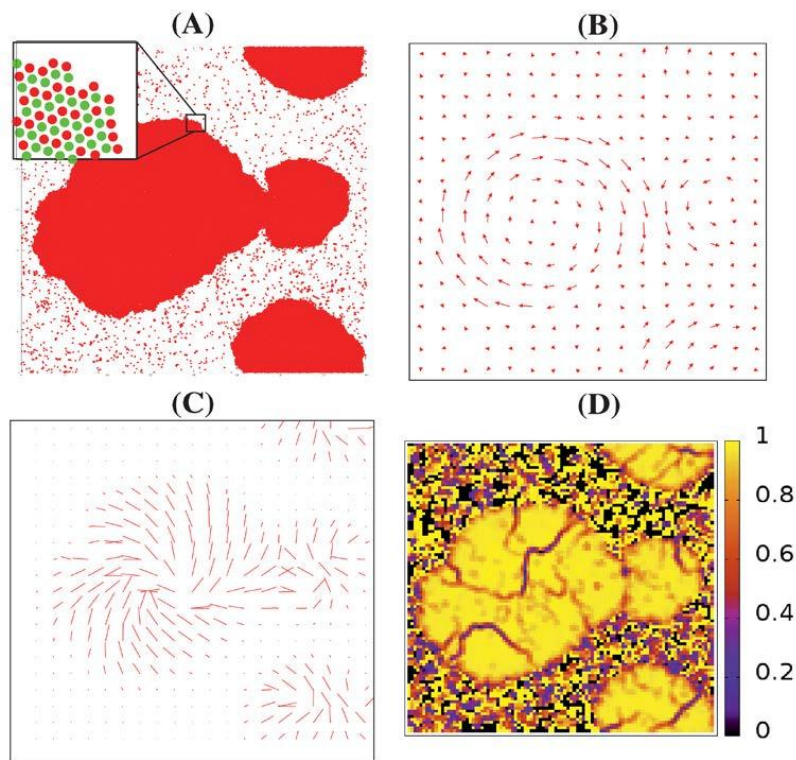
The Physics of Soft and Biological Matter

Motility-induced phase separation in an active dumbbell fluid

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We study a suspension of active dumbbells of variable density, as a minimal example of an active polar fluid. As in a fluid of spherical swimmers, we find that motility triggers a non-equilibrium phase separation if the density exceeds a critical threshold. We also show that the phase separation is lost when the active force becomes too large, ultimately due to inertial effects. Unlike their spherical counterparts, the aggregates which assemble spontaneously break chiral symmetry and rotate; they also display a nematic ordering with spiral patterns. An example of such an aggregate is given below.



(A) Snapshot of a phase-separated active dumbbell fluid with three clusters (two of which are touching). The inset shows a detail of the dumbbell configuration; red and green beads indicate the tail and head of the dumbbells respectively. (B) Coarse grained velocity field corresponding to the snapshot in (A). (C) Coarse-grained orientation profile of the dumbbell fluid (P) corresponding to the configuration in (A). (D) Hexatic order parameter corresponding to the configuration in (A).