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Collective behavior of chemotactic colloids: clusters, asters and oscillations SUROPRIYA SAHA, Department of Physics, Indian Institute of Science, RAMIN GOLESTANIAN, Rudolf Peierls Institute of Theoretical Physics, Oxford, UK, SRIRAM RAMASWAMY, TIFR Center for Interdisciplinary Sciences, Hyderabad, India — Catalytic colloidal swimmers are a particularly promising example of systems that emulate properties of living matter, such as motility, gradient-sensing, signaling and replication. Here we present a comprehensive theoretical description of dynamics of an individual patterned catalytic colloid, leading controllably to chemotactic or anti-chemotactic behavior. We find that both the positional and the orientational degrees of freedom of the active colloids can exhibit condensation, signaling formation of clusters and asters. The kinetics of catalysis introduces a natural control parameter for the range of the interaction mediated by the diffusing chemical species. For various regimes in parameter space in the long-ranged limit our system displays precise analogs to gravitational collapse, plasma oscillations and electrostatic screening. We present prescriptions for how to tune the surface properties of the colloids during fabrication to achieve each type of behavior.

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