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Activity and density dependence of collective states in confined bacterial suspensions[1] DIPANJAN GHOSH, XIANG CHENG, University of Minnesota — Suspensions of microswimmers such as swimming bacteria, algae and spermatozoa are naturally found in confined spaces. To understand how geometric confinement affects the collective behavior of microswimmers, we conduct experiments using genetically engineered *Escherichia coli*, whose swimming speed can be controlled via the intensity of illuminating light. We find that the *E. coli* suspensions, when placed in quasi-two dimensional Hele-Shaw cells, exhibit various ordered states that are not seen in their three dimensional counterparts. Particularly, by tracking the positions and orientations of individual bacteria, we identify three distinct states, i.e., a disordered state, a laning state with nematic symmetry, and a swarming cluster state with polar alignment. A phase diagram of bacterial suspensions under confinement is mapped as a function of the concentration and swimming speed of bacteria. We also discuss the nature of interactions that are responsible for the emergence of the ordered states. Our study provides an experimental benchmark for understanding the collective behavior of microswimmers in confined geometries, laying emphasis on how emergent ordered states depend on the dimensions and boundaries of the system.

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