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Emergent large-scale behavor in collonies of swimming bacteria[1]
ANDREY SOKOLOV, Illinois Institute of Technology, IGOR ARANSON, Argonne National Laboratory, RAYMOND GOLDSTEIN, University of Arizona, JOHN KESSLER, University of Arizona — *Bacillus subtilis* are flagellated, rod-shaped micro-organisms, 5-10 microns long and capable of swimming up to 20 microns/second. The hydrodynamic and chemical interactions between individual cells results in remarkably rich collective behavior; self-concentration due to gradients of dissolved oxygen or pH level; phase transitions and self-organization in confined geometries. The self-organization often takes the form of coherent structures with typical sizes that are many times larger than those of the individual bacteria. We conducted experimental investigation of emergent collective behavior in dense bacterial colonies. The studies were performed in thin liquid film with controlled thickness. We presented a new way of controlling the density of bacteria and separation of living and dead cells by transmitting electric current. We explored experimentally the dependence of the scales of emergent dynamic structures on the concentration of cells.

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Igor Aronson
Argonne National Laboratory

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