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Combing bacterial turbulence.[1] ANDREY SOKOLOV, Argonne National Laboratory, DAIKI NISHIGUCHI, The University of Tokyo, IGOR ARONSON, Penn State University — Living systems represented by ensembles of motile organisms demonstrate a transition from a chaotic motion to a highly ordered state. Examples of such living systems include suspensions of bacteria, schools of fish, flocks of birds and even crowds of people. In spite of significant differences in interacting mechanisms and motion scales, ordered living systems have many similarities: short-range alignment of organism, turbulent-like motion, emergence of large-scale flows and dynamic vortices. In this work, we rectify a turbulent dynamics in suspensions of swimming bacteria Bacillus subtilis by imposing periodical constraints on bacterial motion. Bacteria, swimming between periodically placed microscopic vertical pillars, may self-organize in a stable lattice of vortices. We demonstrate the emergence of a strong anti-ferromagnetic order of bacterial vortices in a rectangular lattice of pillars. Hydrodynamic interaction between vortices increases the stability of an emerged pattern. The highest stability of vortices in the anti-ferromagnetic lattice and the fastest vortices speed were observed in structures with the periods comparable with a correlation length of bacterial unconstrained motion.

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