UNIVERSITY OF MIAMI
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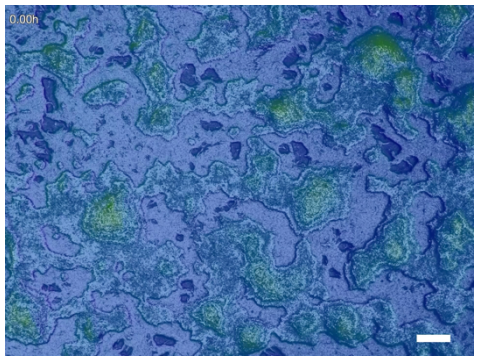
University of Miami, Physics Department Colloquium

Date: Wednesday, September 23rd, 2026
Time: 4:00 pm – 5:00 pm
Location: Wilder Auditorium – Room 112, Knight Physics Building

Active Matter from the Bottom Up: Motility, Defects, and Surface Waves in *Myxococcus xanthus*

Dr. Joshua Shaevitz
Princeton University



Abstract: How can micrometer-scale organisms generate the forces and patterns of a macroscopic material? I will explore this question using the soil bacterium *Myxococcus xanthus*, whose gliding cells collectively hunt, reorganize, and build three-dimensional structures containing millions of individuals. I will begin with the physical basis of motility and the role of capillary forces in coupling cell motion to the surrounding fluid and substrate. I will then show how dense populations form active nematic states, in which orientational order and topological defects organize flows and shape the colony. These active stresses drive the formation of layers, holes, and fruiting bodies, revealing how a living material can sculpt its own 3-D architecture. I will close with rippling, a striking collective instability that has traditionally been attributed to the synchronization of cell motility. We find instead through three-dimensional observations that rippling is a surface-wave phenomenon emerging at the top of a thick active material. Treating the colony as an active nematic liquid crystal explains how its boundary can spontaneously undulate, and why the resulting pattern is tuned by both interfacial tension and the mechanical properties of the substrate. Together, these results connect bacterial motility to active liquid crystals, capillary phenomena, and the physics of pattern formation far from equilibrium.

Biography: Dr. Joshua Shaevitz is professor of physics and biophysics in the Department of Physics and Lewis-Sigler Institute for Integrative Genomics at Princeton University. He did undergraduate work at Columbia University in New York and received his Ph.D. in physics from Stanford University in 2004. Prior to his appointment at Princeton, he was a Miller Research Fellow at the University of California, Berkeley. Shaevitz's work focuses on precision measurements in a variety of biological systems, focusing on topics related to cell shape in bacteria, active matter and pattern formation in groups of moving cells, and the quantification of animal behavior. He is the recipient of several awards and honors, including an NSF CAREER Award, an APS Fellowship, and PECASE, among others. He also serves as co-Director of the Center for the Physics of Biological Function and is the Director of Graduate Studies for the Graduate Program in Biophysics at Princeton University.