PHYSICAL MATH SEMINAR

Emergent Spatiotemporal Patterns in Insect Swarms

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ABSTRACT:

For the overwhelming majority of organisms, effective communication and coordination are critical in the quest to survive and reproduce. A better understanding of these processes can benefit from physics, mathematics, and computer science – via the application of concepts like energetic cost, compression (minimization of bits to represent information), and detectability (high signal-to-noise-ratio). My lab's goal is to formulate and test phenomenological theories about natural signal design principles and their emergent spatiotemporal patterns. To that end, we adopted insect swarms as a model system for identifying how organisms harness the dynamics of communication signals, perform spatiotemporal integration of these signals, and propagate those signals to neighboring organisms. In this talk, I will focus on two types of communication in insect swarms: visual communication, in which fireflies communicate over long distances using light signals, and chemical communication, in which bees serve as signal amplifiers to propagate pheromone-based information about the queen's location. Through a combination of behavioral assays and computational techniques, we develop and test model-driven hypotheses to gain a deeper understanding of these communication processes and contribute to the broader understanding of animal communication.

TUESDAY, NOVEMBER 18, 2025

2:30 PM – 3:30 PM

Building 2, Room 449

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