Quantitative
Eco/evo/etho
Discussions

The Physics of Firefly Communications: Principles and Predictions

April 5th (Tuesday): 4-5pm ET

Prof. Orit Peleg

Fireflies offer a unique and rare glimpse into animal communication. Their signal comprises a species-specific on/off light pattern repeated periodically, used by individual fireflies to advertise themselves to potential mates. Detecting individuals becomes increasingly challenging at high densities of fireflies. In this talk, I will explore how fireflies approach this problem while using physics and information-theory concepts, e.g., energetic cost and compression (minimization of bits representing information) and detectability (high signal-to-noise-ratio). The first approach involves signal amplification via synchronization within swarms containing tens of thousands of individuals. Our recent quantitative measurements of the three-dimensional spatiotemporal flashing pattern of synchronous firefly swarms allow us to validate a set of mathematical models that account for short-range spatial correlations and the signal's emergent periodicity. The second approach involves the evolutionary design of light patterns with increased detectability at other individuals' expense. Using a set of computational models, connected with experimental data, we observe an emergent periodicity in the resulting optimal sequences and demonstrate a method of reconstructing potential cost functions from the phylogenetic relationships of extant species alongside their characteristic flash patterns.

Orit Peleg is an Assistant Professor at the Computer Science Department and the Biofrontiers Institute at the University of Colorado, Boulder. Previously, she earned her BS and MS from the Bar-Ilan University, Israel, followed by a PhD in Materials Science from ETH Zurich, and postdoctoral appointments at Harvard. Her research is aimed at understanding how organisms buffer themselves against large environmental fluctuations and accommodate adaptation over a wide range of length and time scales. In addition to academic outlets, Prof. Peleg's work has been featured widely in popular media such as the New York Times, NPR, and the Guardian.

Hosted by the Soft Math Lab.

Register here!

Contact: Irina Tolkova
Email: itolkova@g.harvard.edu