

Professor Eitan Tadmor
Department of Mathematics
Institute for Physical Science and Technology
University of Maryland
College Park, Maryland, USA

Lowy Distinguished Guest Professor, 2024-2025

"COLLECTIVE DYNAMICS OF ACTIVE PARTICLES"

Lecture Series

On Tuesdays, during January 2025, between 15:00–17:00
Room 309, Schreiber Building

Syllabus

Nature and human societies offer many examples of self-organized behavior: ants form colonies, birds flock, mobile networks synchronize, and consensus may emerge from interaction of diverse human opinions. These are examples of collective dynamics in which small scale interactions of so-called active particles, lead to the emergence of large-scale patterns.

We will survey recent mathematical developments in collective dynamics, covering four main topics.

1. Environmental averaging. Agent-based description of swarm dynamics on graphs, governed by different protocols of alignment, attraction, repulsion, anticipation. Collisions are avoided.
2. Mean-field. From empirical measure to mean-field limit — the passage to kinetic description.
3. Large crowd dynamics. The passage to hydrodynamic description. Closure of moments, pressure and energy fluctuations
4. Large time dynamics. How different protocols of communication affect non-equilibrium fluctuations, leading to the emergence of consensus, flocking, multi-species, etc.