PHYSICAL MATHEMATICS SEMINAR

Uncovering spatiotemporal coherence in living and non-living matter

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ABSTRACT:

Advances in experimental technologies have unlocked a set of previously unobservable phenomena ranging from turbulent flows in environmental sciences to the coordinated motion of thousands of cells during embryonic development. These systems, defined by finite-time datasets, exhibit nonlinear, multi-scale and chaotic behaviors, and disentangling their complex paths and unveiling their mechanistic basis require new techniques and ideas. Using concepts from calculus of variations, differential geometry and Hamiltonian systems, I discuss the development of mathematical tools that unveil the intrinsic geometric organizers (or Coherent Structures) of the dynamical systems' phase space. I illustrate these results on challenging experiments related to atmospheric flows, highly unsteady separated flows, search and rescue operations at sea, and morphogenetic multicellular flows during embryonic development. I show how these techniques uncover previously unknown structures, which include the onset of aerodynamic separation, hidden short-term attractors on the ocean surface and new biological features that shed light on when cells became fated during embryogenesis.

TUESDAY, FEBRUARY 11, 2020
2:30 PM – 3:30 PM
Building 2, Room 139

Reception following in Building 2, Room 290
(Math Dept. Common Room)

http://math.mit.edu/seminars/pms/

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