



Princeton Center for Theoretical Science presents
Sixth Annual Visiting Lectureship Series, 2016

Professor Michael Brenner

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Harvard University

Talks and Abstracts

24 February 2016

2:30 pm

Room 407 Jadwin Hall, PCTS

Condensed Matter Seminar: *Towards Artificial Living Materials*

Biological systems provide an inspiration for creating a new paradigm for materials synthesis. Imagine it were possible to create an inanimate material that could both perform some function, e.g. catalyze a set of reactions, and also self replicate. Changing the parameters governing such a system would allow the possibility of evolving materials with interesting properties by carrying out “mutation-selection” cycles on the functional outcomes. Although we are quite far from realizing such a vision in the laboratory, recent experimental advances in coating colloidal scale objects with specific glues (e.g. using complementary DNA strands) have suggested a set of theoretical models in which the possibilities of realizing these ideas can be explored in a controlled way. This talk will describe our ongoing efforts to explore these ideas using theory and simulation, and also small scale experiments.

25 February 2016—Public Lecture

8:00 pm

McDonnell Hall, Room A-02

Science and Cooking

Bubbles, droplets, fluid flows, phase transitions, molecular viscosity and elasticity. Welcome to the world of science and cooking! Every cook - whether a top chef or just a humble cook at home - uses these physical principles. This lecture uses food and cooking to explicate fundamental principles in applied physics and engineering. Finally you will understand why it is so hard to cook a decent steak!

1 March 2016

4:30 pm

Room 343 Jadwin Hall

Math Physics Seminar: *A Potential Mechanism for a Singular Solution of the Euler Equation*

I will describe a potential mechanism for a singular solution of the Euler equation. The mechanism involves the interaction of vortex filaments, but occurs sufficiently quickly and at a small enough scales that could have plausibly evaded experimental and computational detection. Joint work with Sahand Hormoz and Alain Pumir.

3 March 2016

12:30 pm

Room 407 Jadwin Hall, PCTS

Biophysics Seminar: *Signal Propagation in a Slime*

Individuals can function as integrated organisms only when information and resources are shared across a body. Signals and substrates are commonly moved using fluids, often channeled through a network of tubes. I will discuss signal transduction and propagation in the slime mold *Physarum polycephalum*, which grows as a random network of tubes, foraging for nutrients. We demonstrate theoretically and experimentally that a version of peristalsis operates in this system, in which a coordinated wave pattern causes bulk transport across the organism. Strikingly the wavelength of the pattern tunes itself to the size of the organism. We identify experimentally the mode of signal propagation for the organism learning about a new food source, and show theoretically that this arises naturally as the coupling between the transported nutrient and the contractions of the cell wall.