PHYSICAL MATHEMATICS SEMINAR

Curvature-induced symmetry breaking of elastic surface patterns

NORBERT STOOP

Massachusetts Institute of Technology

ABSTRACT:

Buckling and folding of curved multi-layered surfaces are ubiquitous phenomena, from embryogenesis and biological tissue differentiation to structure formation in heterogenous thin films or on planetary surfaces. Yet, owing to the nonlinearity of the underlying stretching and bending forces, current theoretical models cannot reliably predict the experimentally observed symmetry-breaking transitions in such systems. Here, we derive a generalized Swift-Hohenberg theory capable of describing the wrinkling morphology and pattern selection in curved elastic bilayer materials. Testing the theory against experiments on spherically shaped surfaces, we find quantitative agreement with analytical predictions for the critical curves separating labyrinth, hybrid and hexagonal phases. A comparison with earlier experiments suggests that the theory is universally applicable to macroscopic and microscopic systems. Since our approach builds on general differential-geometric principles, it extends to arbitrarily shaped surfaces, thereby solving a longstanding problem in elasticity theory.

TUESDAY, SEPTEMBER 16, 2014
2:30 PM
Building E17, Room 122

Reception following in Building E17, Room 401A
(Math Dept. Common Room)

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

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