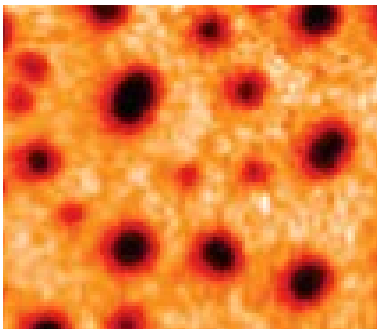
PY 722: Statistical Physics II

Fluctuations and Phase Transitions



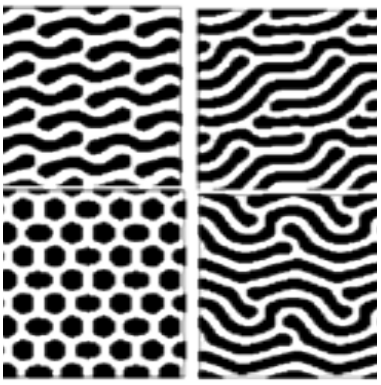
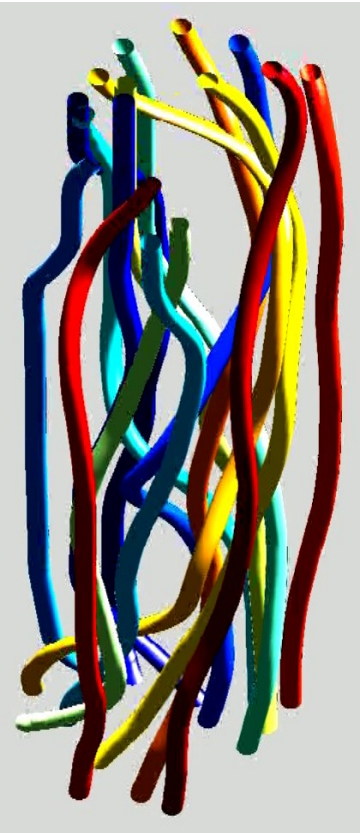


Image credits: Ade (UL), Sagui/Roland (LL), Lechenault/Daniels (R)

- ergodicity, entropy, and free energy
- phase transitions & symmetry-breaking
- order parameters
- mean field approximation
- critical phenomena & renormalization group
- universality
- spatial and temporal correlations, linear response
- fluctuation-dissipation theorem
- Ising model
- nucleation & coarsening
- Levy flights & anomalous diffusion
- percolation
- front-propagation



Instructor: Karen Daniels, 258C Riddick, karen_daniels@ncsu.edu

Course Time: T/H 11:45 to 1:00, 314 Riddick (Fall 2009)

Prerequisite: PY721 preferred, but not required. Familiarity with the laws of thermodynamics, kinetic theory of gases, entropy, free energy, and ensembles.

Course format: Upper-level graduate course with ~biweekly problem sets and take-home exams. Emphasis on current, inter-disciplinary applications and experiments, using both computational and analytic techniques. Final paper/project: review-type paper on a current application of a statistical physics topic.

Textbook: James Sethna, *Entropy, Order Parameters, and Complexity*. Preview the book online at http://pages.physics.cornell.edu/sethna/StatMech/

Supplemental material from Chandler, *Introduction to Statistical Mechanics* and Chaikin & Lubensky, *Principles of Condensed Matter Physics*.