

## Material for Week 9

Physics 4488/6562: Statistical Mechanics

<http://www.physics.cornell.edu/sethna/teaching/562/>

Exercises due Mon. Apr 13

Last correction at April 18, 2020, 12:01 pm

©2018, James Sethna, all rights reserved

For Friday, do part (a) of the pre-class exercise before class; we shall continue with part (b) during class.

### Monday

In-class question: [8.5](#) *Detailed balance*

### Wednesday

Read: Chapter 8, Sec. (8.3) (What is a Phase? Perturbation theory)

Pre-class question: [8.18](#) *Ising low temperature expansion*

In-class question: [8.19](#) *2D Ising cluster expansions*

### Friday

Read: Chapter 9, *Order parameters, broken symmetry, and topology*, Sec. (9.1) (Broken symmetry) and (9.2) (Order parameter)

Pre-class question: [9.9](#) *Ising order parameter*

Pre-class question: [9.10](#) *Nematic order parameter*

In-class question: [9.10](#) *Nematic order parameter*

### Monday

Read: Chapter 9, Sec. (9.3) (Examine the elementary excitations)

Pre-class question: [9.15](#) *Superfluid second sound*

## Exercises

Everyone (4488 and 6562)

[8.6](#) *Metropolis.*

[8.8](#) *Wolff.*

[8.20](#) *Fruit flies and Markov.*

Gordon Berman, a former Cornell grad student, later used machine learning to study fly behavior. You can study a proposed Markov matrix for the fly's transitions between idle (sleep), grooming, and locomotion. You can explore detailed balance, steady states, entropy, and free energy evolution for the model fly, and compare to your expectations about real flies.

Graduate (6562 only)

[8.21](#) *Metastability and Markov.*

[9.5](#) *Landau theory for the Ising model.*