

## Material for Week 8

Physics 4488/6562: Statistical Mechanics

<https://sethna.lassp.cornell.edu/Teaching/562/>

Exercises due Mon. Mar 18

Last correction at November 29, 2023, 9:47 pm

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On Wednesday, you will be running simulations during class. They should run on laptops, tablets, or smart phones.

### Monday

In-class question: [7.24](#) *Is sound a quasiparticle?*

### Wednesday

Read: Chapter 8, Sec. (8.1) (The Ising model)

Pre-class question: [8.16](#) *Ising hard disks*

In-class question: [8.1](#) *The Ising model*

In-class question: [8.17](#) *Ising parallel updates*

### Friday

Read: Chapter 8, Sec. 8.2 (Markov Chains)

Pre-class question: [8.3](#) *Coin flips and Markov*

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

### Monday

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

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

### Exercises for everyone

[8.20](#) *Unicycle.*

### Select zero – one (4488) or one – two (6562)

[7.16](#) *White dwarfs, neutron stars, and black holes.* (Astrophysics, Quantum) Cold stars don't collapse because they are made of fermions – until they get too massive

[7.26](#) *Entanglement of two spins.* (Quantum, Computation) Entanglement with an unobservable state increases entropy.

[8.2](#) *Ising fluctuations and susceptibilities.* (Computation) Using Bierbaum's "ising.js" simulation to test predictions for the relation between fluctuations and susceptibilities in the Ising model.

[8.4](#) *Red and green bacteria.* (Mathematics, Biology) Try analyzing the extinction rate, this time with Markov chains.

[7.27](#) *Heisenberg entanglement.* Computing entanglement and testing the eigenstate thermalization hypothesis. Hints at <https://sethna.lassp.cornell.edu/StatMech/EOPCHintsAndMaterials.html>

[N4.43](#) *Supersymmetric harmonic oscillator.* (Quantum, Supersymmetry) [Not technically stat mech], the simplest supersymmetric QM model