**Phys 114** **Week 9: Amy's reading advice** **2021**

**My observations about reading this week:**

**1 G&T Sections 5.1-5.7** have everything you need this week

**2.B&B Section 28.8** is very short ... 4 pages. I recommend it as it emphasizes some pivotal results in G&T

- How order and disorder compete to produce the ferromagnetic transition in the Ising model
- The idea behind the Metropolis algorithm for a Monte Carlo simulation of the Ising model
- How to find *C* and $\chi$ from fluctuations in *E* and *M*, respectively.
- The way magnetization, specific heat, and energy look as a function of *T* ... especially near $T_c$.
- A picture of how the spins look at various *T* below and above $T_c$.

**3.** What **Schroeder Section 8.2** can add:

- It solves the *1d H=0* Ising model and points out how similar the results are to those of a paramagnet, if we interpret the spin-spin interaction (which Schroeder calls $\varepsilon$) with the spin-magnetic field interaction (which we often call $\mu B$).

- It does the Mean field approximation, but in less detail than G&T do. It stops at finding the expected value of *m*, which Schroeder calls $\bar{s}$ . G&T take a slightly more theoretical approach, and talk about a trial form for the free energy - finding the value of *m* which minimizes it.

- It contains an accessible but complete description of the Metropolis Monte Carlo simulation algorithm. It tells us that this technique is called "importance sampling" because it is biased toward producing microstates with a greater likelihood. It states that this algorithm produces ``detailed balance". This means that the rate at which state 1 might lead to state 2 is what one hopes: the Boltzmann factor $exp[(E_1 - E_2)/kT$.

- It has a pseudocode on p. 349, which one could readily turn into Python if one wishes. Of course, there are plenty of Python Ising model codes which one can download from the Web. See for example https://rajeshrinet.github.io/blog/2014/ising-model/