Phys 33765-**Statistical Mechanics**—Spring 2021

Time and place: 9:10-10 MWF, 2:10-3 Th

Instructor: Ira Rothstein, Room Wean 7406, Phone 268-2739,
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Office hours: to be announced

Grading:

Grades will be based on HW, the midterm and final. The weighting will be: HW %20, midterm %30 and final %50.

Texts:

Reading assignments will be from lecture notes provided by the instructor as well as from the the book "Equilibrium and Non-Equilibrium Statistical Thermodynamics", by Le Bellac, Mortessagne and Batrouni, Cambridge Univ. Press.

Lecture plan: Each of these topics will take 1-2 lectures.

Part 1: Equilibrium Physics

1. What is Statistical Mechanics: Review of classical and quantum mechanics.
2. Information and Entropy
3. The classical and quantum definitions of Entropy
4. Equilibrium and its definition and the 2nd Law of thermodynamics
5. Extrinsic and Intrinsic Variables as describing equilibrium states.
6. Micro-canonical versus canonical ensembles: Fluctuations and dissipation theorems.
7. Ideal gases as a toy model.
8. From ideal gases to liquids and solids
9. Phase Transitions and critical phenomena: correlation functions and critical exponents (the Ising model)
10. Landau Theory: Mean field theory
11. Renormalization Group I: Theory
12. Renormalization Group II: Examples of Fixed points

13. The chemical potential and the grand canonical ensemble.
14. Quantum Statistics: Fermi-Dirac and Bose distributions
15. Ideal Fermi gases and theory of metals
16. Bose Einstein Condensates

Part 2: Non-equilibrium phenomena

1. Irreversible Processes and conservation Laws
2. Transport Coefficients, dissipation and entropy production
3. Hydrodyamics
4. Kinetic Theory
5. The Boltamann equation
6. Linear response theory: classical
7. Linear resonse theory: quantum
8. The Langevin equation.