

PHY 6536 —Statistical Mechanics I

Course Syllabus

In this course we will study “statistical physics.” This subject is a link between the microscopic world of one or two particles and the macroscopic world of Avogadro’s number of little particles, all the same. In the micro-world, energy is conserved; the equations are exact, reversible, and can be solved at any level of detail required. In the macro-world the details are lost in some thermodynamic limit; we work with very general relationships among macroscopic properties of systems; and entropy always increases.

Background needed is thermodynamics at the undergraduate level, mechanics, and quantum mechanics. There will be homework, a midterm exam, and one final.

A tentative list of topics that which will be addressed is the following:

1. Review of thermodynamics and kinetic theory.
2. Classical statistical mechanics, and the microcanonical ensemble.
3. Canonical and grand-canonical ensembles.
4. Quantum statistical mechanics.
5. Fermions.
6. Bosons.
7. Superfluids.
8. Magnets: Ising model.
9. Critical phenomena, scaling.
10. Ginsberg-Landau theory.

We will have homework approximately every other week, due on Mondays, a midterm during the week of March 16, and a final exam.

The textbook will be K. Huang, *Statistical Mechanics* (John Wiley & Sons 1987).

Other useful books are

1. F. Reif, *Fundamentals of Statistical and Thermal Physics* (McGraw-Hill, 1988).
2. L.D.. Landau and E.M. Lifshitz, *Statistical Physics* (Pergamon Press, 1989).
3. J.P. Sethna, *Statistical Mechanics: Entropy, Order Parameters and Complexity* (Oxford University Press, 2006).
4. H.B. Callen, *Thermodynamics* (John Wiley & Sons 1965).

Course number: PHY 6536
Times & Place: MWF 6th period (12:50–1:40 pm) — NPB 1101
Web site: <http://www.phys.ufl.edu/~tanner/Phy6536.html>
Instructor: David Tanner
Office & phone: 2372 NPB — 392-4718
Office hours: 11:00–12:00 Wed and Fri
Final exam: Apr 29, Wednesday, 7:30–9:30 am