

## PHY 6536 —Statistical Mechanics I

### Spring 2018 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 a final.

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

1. Review of thermodynamics and statistical methods.
2. Classical statistical mechanics, and the microcanonical ensemble.
3. Phase space dynamics and entropy.
4. Canonical and grand-canonical ensembles.
5. Quantum statistical mechanics.
6. Fermions and bosons.
7. Order parameters and phase transitions.
8. Superfluids.
9. Magnets: Ising model.
10. Critical phenomena, scaling.
11. Ginsburg-Landau theory.

**We will have homework approximately every week, due on Mondays, a midterm on Wednesday, February 28, and a final exam on April 28 (to be confirmed).**

The textbook will be: R.K. Pathria, Paul D. Beale Statistical Mechanics (Third edition, 2011)

Additional text: J.P. Sethna, *Statistical Mechanics: Entropy, Order Parameters and Complexity* (Oxford University Press, 2006)

Introductory text: Roger Bowley, Mariana Sanchez, *Introductory Statistical Mechanics*

Lecture notes: *Advanced Statistical Mechanics*, AP3021G Jos Thijssen,

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. K. Huang, *Statistical Mechanics* (John Wiley & Sons 1987).
4. H.B. Callen, *Thermodynamics* (John Wiley & Sons 1965).

Course number: PHY 6536

Times & Place: MWF 3th period (9.35–10.25 am) — NPB 1101

Web site: <http://www.phys.ufl.edu/~sergei/Phy6536.html>

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Midterm: Wednesday, February 28

Final exam: April 28, Tuesday, 10 am-12 pm (to be confirmed).

Grades will be based on one midterm exam (25%), one final (35%) and homework (40%).