

Physics 216 Spring 2016
Special topics in many-body physics
Course information sheet

Instructor

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Course webpage (should be live now): <http://knowen.org/nodes/829>

Lectures: TuTh 2:00-3:30, 385 LeConte Hall

Office hours: TBA

Lectures that will have to be rescheduled: Tuesday February 9; Thursday February 18.

There may or may not be a half-time GSI, depending on course enrollment. I am currently expecting to give problem sets and possibly a take-home exam or final project, but no in-class exams.

There are no discussion sections scheduled at this time. Students who have already taken 216 (or who have a Ph.D.) are welcome to audit informally. Others are encouraged to register.

Tentative syllabus

This course discusses several of the most important discoveries in the recent history of condensed matter physics. The course will focus on physics content rather than formalism, and should be accessible with minimal work to experimentalists and people from backgrounds other than condensed matter. The prerequisites are a solid semester-long course in statistical physics and another in solid-state physics.

About half of the course material can be found in Auerbach, *Interacting electrons and quantum magnetism*. Lecture notes will be provided, and some useful additional references will be placed on reserve in the physics library.

1. Introductory concepts

- Jordan-Wigner transform and 1D equivalence of spins, fermions, and bosons.
- Fermi liquid theory, second quantization, coherent states.
- Bose-Einstein condensation, superconductivity, and superfluidity. Bose-Hubbard model.
- Introduction to response functions, experimental probes, and perturbation theory.

2. Magnetism and other spin physics

- Magnetism in simple models of solids (Fermi-Hubbard model).
- Frustration and spin liquids.
- Itinerant magnetism.
- Phenomenology of the Kondo effect.

3. Transport and optical properties of interacting electron systems

4. Microscopic pictures of normal and unconventional superconductors

5. Further topics as time permits