Course Syllabus for PHYS 7440, Theory of the Solid State

Instructor: Michael Hermele  
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Office Hours: Tuesday 11am-12pm, Wednesday 2-3:30pm, or by appointment

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Lectures: Tuesday and Thursday, 9:30 – 10:45am, Duane G1B27

Course webpage: http://www.colorado.edu/physics/phys7440

Course description: This is an introductory graduate-level course in solid state physics, focusing on electronic properties of solids. The aim of this course is to understand the physics without getting bogged down in formalism – this does not mean we won’t learn some formalism, but it does mean we will not be using field theory or diagrammatic techniques.

Textbook: Solid State Physics, by N. W. Ashcroft and N. D. Mermin. I will also mention potentially useful references for specific topics as we go along.

Prerequisites: The most important prerequisite is a strong background in quantum mechanics. Some background in thermodynamics/statistical mechanics will also be helpful.

Rough outline of topics to be covered: Free Fermi gas; basic transport theory (Drude model and Boltzmann equation); interacting Fermi gas (Hartree-Fock, screening); Fermi liquid theory; crystal lattices; band theory (electrons in a periodic potential); semiclassical dynamics and transport of band electrons; semiconductors; anomalous Hall effect and the Berry phase; lattice vibrations; electron-phonon interaction; temperature dependence of electrical resistivity; magnetism; BCS theory of superconductivity

Additional topics: Solid state physics is made up of a vast and diverse array of topics, and thus there is some flexibility in the topics we will cover this semester. Please let me know what you want to learn – if there is significant interest in a topic, I will try to include it in the course. I’ll be soliciting your suggestions on the first homework assignment.

Grading: The course grade will be based on homework assignments and on a final exam. The final exam will be “take home.” Collaboration is encouraged on the homework, but is not allowed on the exam.
**Some “fine print” items**

**Disabilities:** If you qualify for accommodations because of a disability, please submit to me a letter from Disability Services in a timely manner so that your needs may be addressed. Disability Services determines accommodations based on documented disabilities. Contact: 303-492-8671, Willard 322, and [http://www.colorado.edu/disabilityservices](http://www.colorado.edu/disabilityservices)

**Religious observances:** Campus policy regarding religious observances requires that faculty make every effort to reasonably and fairly deal with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, please let me know as soon as possible if you anticipate a conflict with one of the assignments or the exam. Significant flexibility with both the assignments and the exam is possible, so it should be easy to work out solutions to any conflicts.

**Statement from the Office of Discrimination and Harassment:** The University of Colorado at Boulder policy on Discrimination and Harassment, the University of Colorado policy on Sexual Harassment and the University of Colorado policy on Amorous Relationships apply to all students, staff and faculty. Any student, staff or faculty member who believes s/he has been the subject of discrimination or harassment based upon race, color, national origin, sex, age, disability, religion, sexual orientation, or veteran status should contact the Office of Discrimination and Harassment (ODH) at 303-492-2127 or the Office of Judicial Affairs at 303-492-5550. Information about the ODH, the above referenced policies and the campus resources available to assist individuals regarding discrimination or harassment can be obtained at [http://www.colorado.edu/odh](http://www.colorado.edu/odh)