Harvard University

Physics 295a: Introduction to the Quantum Theory of Solids

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Fall 2024 Mon-Wed-Fri, 12:00-01:15 PM, Cruft 309

All class materials can be obtained from canvas.harvard.edu/courses/137025
I plan to record and post all lectures, but you are urged to attend the live lectures and participate in the discussion.

This is a first course in modern condensed matter physics. The course will be mostly based on the following books

- *Solid State Physics* by Neil W. Ashcroft and N. David Mermin, Thomson Press
- *Modern Condensed Matter Physics* by S. G. Girvin and K. Yang, Cambridge University Press

I will also hand out my own lecture notes.

Proposed outline:

1. Sommerfeld Theory of Metals
2. Crystal Lattices
3. Electron Levels in a Periodic Potential
4. Semiclassical Theory of Electron Dynamics
5. Phonons
6. Semiconductors
7. Integer Quantum Hall Effect
8. Topology and Berry Phase
9. Topological Insulators and Semimetals
10. Magnetism

There will be regular problem sets, one about every 10 days, and a 24-hour take home final exam.