PHYS 5243
Solid State Physics

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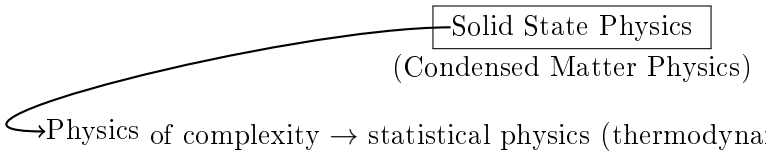
Contents

2015-01-09: Chapter 1 - About Condensed Matter Physics

Syllabus

Read Chapters 1 and 2 before next lecture
Graduate Student → 15% of the grade is HW.
2 Midterms: Wednesday nights (∼ 4 hours are given to do them).
The Final counts for ∼ 25% of grade for Graduate and Undergraduate Students.
Get the other books required for class → they are important!
Graduate Studnet difference → potentially a physics simulation will be required.

Class Notes



Collections of atoms

Somewhat under atomic physics field

Solids, liquids, and polymers

Hamiltonian:

$$\hat{H} = \underbrace{\frac{\mathbf{p_n}^2}{2M_n}}_{\substack{momentum\\ of\\ ions}} + \underbrace{\frac{\mathbf{p_e}^2}{2M_e}}_{\substack{momentum\\ of\\ electrons}} + \underbrace{\frac{e^2}{r_{i1}-r_{j1}}}_{\substack{repulsion\\ between\\ ions}} + \underbrace{\frac{e^2}{r_{i2}-r_{j2}}}_{\substack{repulsion\\ between\\ electrons}} - \underbrace{\frac{e^2}{r_{i1}-r_{j2}}}_{\substack{attraction\\ between\\ electrons\ and\ ions}}$$

At the moment only ∼100 atoms can be solved (using supercomputer) → very difficult!

Emergent phenomenon is common

Superconductivity is emergent from collection of atoms

2015-02-20: Chapter 1 (Kittel) - Crystal Structure

Test on Everything but Crystal Structure. Closed book but will provide equations.

Primitive Cells

Crystal Structure handout.

(100) plane of atoms.

{**100**} family of planes.

[100] direction.