Solid State Physics

Aron Pinczuk

Transcribed by Ron Wu

This is a graduate course. Offered in Fall 2013 at Columbia University. Required Course textbooks: Ashcroft, Mermin, *Solid State Physics;* Simon, *The Oxford Solid State Basics.* Optional text: Kittel, Introduction to Solid State Physics. Office hours by appointments.

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Course Overview

Lecture 1 (9/4/13)

We study a large collection of particles, colloquially known as a condensed matter system, which has typical three phases: gases, liquids and solids, linked by phase transformations. We mainly focus on solids. There are three traditional types: crystalline, amorphous, and structures of reduced dimension (e.g. nanostructures).

There are also emergent states, e.g. superfluids ^{4}He, quantum hall fluid. One significance of superfluids ^{4}He is that it demonstrates fountain effect: quantum behavior on a macroscopic scale. A superconductor, a quantum fluid of electrons with no viscosity is another example that could not be predicted nor explained by microscopic models of metals for almost 50 years.

1 Properties of Electrons in Solids

1.1 Drude model

1.2 Sommerfeld model

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