**8.511 Theory of Solids Fall 2015**

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**Lecture:** MW 1:00–2:30 pm, Room 4-153 **Discussion:** F 1:00–2:30 pm, Room 4-153 (start 9/18)

**Office Hours:** Patrick Lee — Wednesday 2:30–3:30 pm

Jacob Colbert — Monday 5:00–6:00 pm

**Outline**:

1. Free electron: Fermi sea

Crystalline lattices

Bloch's theorem

Band structure: Pseudo-potential, (OPW), APW, tight-binding

2. Methods of testing band structures

Survey of periodic table

Semi-classical equation of motion   
Quantum oscillations

Semiconductors: donors, acceptors and excitons

3. Electron-electron interaction

Density functional theory

4. Beyond band theory: Hubbard model and Mott insulator

5. Phonons

Frank-Condon Effect

6. Electron-phonon interaction

Mass enhancement

Effective attraction between electrons

7. Superconductivity

BCS theory

Flux quantization

**Recommended books (not required):**

Ashcroft and Mermin, *Solid State Physics* (Saunders)

Grosso and Parravicini, *Solid State Physics* (Academic Press)

Marder, *Condensed Matter Physics* (Wiley)

**Weekly homework (70%)**

**Quiz (30%)**