

8.512 Theory of Solids (Spring 2007)
web.mit.edu/8.512/www

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Lectures: Tuesday and Thursday, 1:00 – 2:30, Room 26-314

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Lecture notes available through Open Courseware

Outline:

1. Linear response theory:
 - Fluctuation dissipation theorem
 - Scattering experiment
 - f-sum rule

2. Physics of disorder:
 - Kubo formula for conductivity
 - Conductance and sensitivity to boundary conditions
 - Scaling theory of localization
 - Mott variable range hopping
 - Quantum Hall effect

3. Superconductor revisited:
 - Transverse response: Landau diamagnetism
 - Microscopic derivation of London equation
 - Effect of disorder
 - Quasiparticles and coherence factors
 - Ginzburg-Landau theory
 - Vortices and type II superconductors
 - Tunneling and Josephson effect

4. Magnetism:
 - Local moment magnetism, exchange interaction
 - Ferro- and anti-ferro magnet and spin wave theory
 - Band magnetism — Stoner theory, spin density wave

5. Local moment in metals
 - Friedel sum rule
 - Friedel-Anderson model
 - Kondo problem: singlet ground state
 - Kondo resonance

6. Fermi liquid theory
 - Electron spectral function
 - Quasi-particles and Landau interaction parameters
 - Fermi liquid interpretation of the Kondo ground state