

Physics 123B – Condensed Matter Physics

Winter 2012

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SYLLABUS (tentative)

Metals:

- Bloch's theorem and tight binding model
- Application to Graphene
- Measuring the Fermi surface – Landau levels, de Haas-van Alphen

Topological Quantum States of electrons:

- Integer Quantum Hall effect - 2d electron gas, Laughlin wavefunction, edge states, quantized Hall conductivity

Topological Insulators

- 2d topological insulator – importance of spin-orbit interactions
- 3d topological insulator - Toy “Dirac” model

Electron Interaction Effects:

- Fermi liquid theory
- Peierls Instability
- Fractional Quantum Hall effect
- Mott insulators

Quantum Magnetism:

- Single ion
- Exchange interactions
- Collective effects, magnetic ordering

Superconductivity:

- Phenomenology
- London Theory
- Ginzburg-Landau theory
- BCS theory