Condensed Matter Physics 232

Date and time: Tuesdays and Thursdays, 11:40am–1:15pm, ISB 235

Webpage: https://syzranov.physics.ucsc.edu/teaching/Course232winter2019/CondMat.html

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Location: ISB 235

Office hours: Friday, 11:00am-12:00pm or by appointment

Syllabus

- Introduction. Subject of condensed matter.
- Landau Fermi-liquid theory. The concept of quasiparticles.
- Distribution function. Density of states. Kinetic equation.
  Drude formulas for transport coefficients.
- Quantum corrections to transport. Weak localisation. Altshuler-Aronov effect.
- Magnetooscillations in mesoscopic structures. Aharonov-Bohm effect.
  Sharvin-Sharvin experiment.
- Anderson localisation[1]. Metal-insulator transition. Scaling theory of localisation.
- Transport in strongly disordered systems. Variable-range hopping.
  Arrhenius, Mott's and Efros-Shklovskii's laws
- Topological semimetals. Graphene. Weyl semimetals. Nodal-line semimetals.
- Quantum wires and ballistic systems. Landauer-Büttiker formalism.
- Landau levels. Quantum Hall effect[1].
- Superconductivity. Phenomenology. Ginzburg-Landau theory. BCS theory[1].

Mark: 40% Midterm Exam + 40% Final Exam + 20% Homework

Recommended literature

- A.A. Abrikosov, "Fundamentals of Theory of Metals"
- V.F. Gantmakher, "Electrons and Disorder in Solids"
- Y. Imry, "Introduction to Mesoscopic Physics"
- V.V. Schmidt et al., "The Physics of Superconductors: Introduction to Fundamentals and Applications"
- J.M. Ziman, "Principles of the Theory of Solids"
- Ch. Kittel, "Introduction to Solid State Physics"

[1] Advanced chapters may be shortened or removed depending on the progress on other topics