Condensed Matter 2

Syllabus

Course Introduction:

This course cover the theoretical developments in condensed matter physics including Bosonization, Fermi liquids, renormalization group, topological field theory and its applications, Berry phase in electronic systems.

Course Plan:

1. Introduction and brief review of second quantization.
2. Bosonization, Luttinger liquids and Fermi liquids.
3. Renormalization group: phi4 theory, critical phenomena
4. Topology and geometry in condensed matter systems: topological insulators, Haldane Model, Berry phase in electronic systems.

References:

1. Eduardo Fradkin, Field Theories of Condensed Matter Systems (2nd edition), Cambridge University Press (2013)
2. B. Andrei Bernevig with Taylor L. Hughes, Topological Insulators and topological superconductors, Princeton University Press (2013)
3. R. Shankar, Quantum Field Theory and Condensed Matter: An Introduction, Cambridge University Press (2017)
4. David Vanderbilt, Berry Phases in Electronic Structure Theory: Electric Polarization, Orbital Magnetization and Topological Insulators, Cambridge University Press (2018).
5. Piers Coleman: Introduction to Many-Body Physics, Cambridge University Press (2016)
6. Alexander Altland and Ben Simons, Condensed Matter Field Theory (2nd edition), Cambridge University Press (2010)
7. Xiao-Gang Wen, Quantum Field Theory of Many-Body Systems, Oxford University Press (2007)