Symmetry and Topology in Condensed Matter

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Main References :

- *Group Theory: Application to the Physics of Condensed Matter*, A. Jorio, M. Dresselhaus, and S. Dresselhaus

- *Group Theory and Quantum Mechanics*, M. Tinkham

- *Lectures on the Quantum Hall Effect*, D. Tong, arXiv:1606.06687

Additional References :

- *Condensed Matter Field Theory*, A. Altland and B. Simons

- *Quantum Phase Transitions*, S. Sachdev

Prerequisites: quantum mechanics, statistical physics, solid state physics

Course Objectives: We discuss symmetry and topology in condensed matter physics. Symmetry and topology are two of the most important concepts in physics, and we learn how to use them. By using examples, we discuss several topics including spontaneous symmetry breaking, symmetry protection of degeneracies, and topological invariant of band structures.

Day 1
- Introduction to symmetry and topology in condensed matter physics
- Group theory : representations and character tables
- Applications of group theory I

Day 2
- Applications of group theory II
- Topological phases : Chern insulators and topological insulators
- Topological phases : Dirac semi-metals