PH364 Jan 3:0

Aveek Bid and Tanmoy Das

Instructor

Topological phases of matter (Theory and experiment)
Email: aveek@iisc.ac.in, tnmydas@iisc.ac.in

Teaching Assistant

Email:

Department: Physics

Course Time:

Lecture venue:

Detailed Course Page:

Announcements

Brief description of the course

The course is aimed at graduate students who want to learn about the fundamentals of the effect of topology on physical properties of condensed matter systems.

Prerequisites

A good understanding of quantum mechanics (at the level of QM II) and of condensed mater physics (at the level of condense matter I).

Syllabus

1. Ahronov-Bohm effect, Berry phase, Berry curvature, Berry connection

2. 1D topological phase: Su-Schrieffer-Heeger model, End state, Zak phase, Kitaev model for p-wave superconductivity and Majorana fermions.

3. 2D topological phases.

4. 3D topological phases

Course outcomes

The students would be exposed to the basic physics of topological phases of mater and their implications in

transport properties of condensed matter systems. They are also expected to gain an understanding of the current level of research, both experimental and theoretical, in topological systems.

Grading policy

25% for pre mid-term examination

25% for mid-term examination

25% for final examination

25% for term-paper

Assignments

Resources

â€œTopological insulatorsâ€•, Shun-Qing Shen, Springer
â€œTopological insulators and topological superconductorsâ€• B. Andrei Bernevig, and T. L. Hughes, Princeton University Press
â€œTopological insulators- The physics of spin helicity in quantum transportâ€• G. Tkachov, Pan Stanford publishing
â€œTopological insulatorsâ€• Marcel Franz, and L. Molenkamp, Elsevier
â€œColloquium: Topological band theoryâ€•, A. Bansil. H. Lin and T. Das, Rev. Mod. Phys. 88, 021004 (2016).
â€œColloquium: Topological insulatorsâ€•, M. Z. Hasan, C. L Kane, Rev. Mod. Phys. 82, 3045 (2010).
â€œTopological insulators and superconductorâ€•, X.-L. Si, S.-C. Zhang, Rev. Mod. Phys. 83, 1057 (2011).