

Condensed Matter Physics

Module No.: MN-P-SP-CondMat, MN-P-PN-CondMat, MN-P-WaMa

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Course: Topological Matter

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Category	Type	Language	Teaching Hours	CP	Semester
Specialized Course	Lecture	English	2	3	

Requirements for participation:

Basic knowledge of condensed matter physics

Type of module examinations:

One oral examination at the end of the module

Duration of the course:

1 semester

Aims of the course:

An important current theme in condensed matter physics is to understand the roles of topology in the quantum mechanics of solid-state systems. In particular, novel quantum effects which emerge as consequences of nontrivial topology in the quantum-mechanical wavefunctions are of fundamental interest, not only because they allow for deeper understanding of nature, but also because they would lead to useful applications that may revolutionize the information technology. This lecture series is aimed at presenting the basic theoretical framework of topological insulators and topological superconductors and showing how they are relevant to actual materials and their applications.

Contents of the course:

Topics covered are:

- Topology in quantum mechanics
- Quantum Hall effect
- Topological insulators
- Topological superconductors
- Majorana fermions
- Detection of topological quantum phenomena

Recommended literature:

- Pedagogical review article (free download): Y. Ando, "Topological Insulator Materials", Journal of the Physical Society of Japan, Vol. 82, 102011 (2013).