Primary Area of Specialization:
General Theory of Relativity / Quantum Field Theory

Module No.: MN-P-SP-GR-QFT

Course: Topology for Physicists

Lecturers: M. Zirnbauer
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Category	Type	Language	Teaching Hours	CP	Semester
Specialized Course	Lecture	English	3+1	6	ST

Requirements

Preparation:
Bachelor of physics or mathematics; the basics of exterior calculus are assumed

Form of Testing and Examination:
written or oral examination

Length of Course:
1 semester

Aims of the course: This course gives an introduction to various topological concepts and results that play an important role in modern theoretical physics.

Contents of the course:

- Elements of homotopy theory: homeomorphic spaces, homotopic maps, fundamental group, covering spaces, homotopy groups, long exact homotopy sequence of a fibration
- Homology and cohomology: Poincare lemma, Mayer-Vietoris sequence, Cech-deRham complex, Hurewicz isomorphism theorem, spectral sequences
- Vector bundles and characteristic classes: Euler form, Thom isomorphism, Chern classes
- Applications: Berry phase; Dirac monopole problem; visualization of closed differential forms by Poincare duality; cohomology of electrical conductance; supersymmetry and Morse theory; index theorems; homotopy classification of topological insulators

Recommended literature:
R. Bott and L.W. Tu: Differential forms in algebraic topology (Springer, 1982)
A.S. Schwarz, Topology for physicists (Springer, 1994)