

**Modules:**

physics700 **Elective Advanced Lectures**  
 physics730 **Theoretical Physics**

**Course:****Topology for Physicists (T)**

Course No.:

Category	Type	Language	Teaching hours	CP	Semester
Elective	Lecture with exercises	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)