

# Topological $K$ -theory

## Thematisches Seminar

Spring 2013, Tuesdays 15-17

The seminar gives an introduction to topological  $K$ -theory, a generalized cohomology theory which was invented by Atiyah and Hirzebruch in the late 1950s to study topological spaces using families of vector spaces.

The topological  $K$ -theory of a topological space  $X$  is a ring  $K(X)$  which measures how many different vector bundles the space  $X$  can carry. Roughly speaking a vector bundle over  $X$  is a family of vector spaces parametrized in a continuous fashion by the points of  $X$ . It turns out that the ring  $K(X)$  depends only on the homotopy type of  $X$  and provides important algebraic invariants of  $X$ . The fundamental property of  $K$ -theory is its periodicity which was first proved by Bott using Morse theory. Following Atiyah's book we will discuss an elementary proof of the periodicity theorem.

Topological  $K$ -theory turned out to be an extremely important tool in mathematics. It allows a few-line proof of Adams theorem on the dimension of division algebras. It is also a key ingredient in the formulation of the Atiyah-Singer index theorem for elliptic differential operators.

The seminar is geared towards third year Bachelor students and Master students with a solid background in linear algebra and analysis. Doctoral students and postdocs who would like to learn more about this important theory are also welcome to participate.

**Prerequisites:** Linear Algebra I + II, Analysis I-III, basic notions of point set topology (as discussed in the course Algebra+Geometry II).

### References

M.F. Atiyah, "K-Theorie", Benjamin Press (1967), ABP (1994)

For a preliminary list of talks see: [http://homeweb1.unifr.ch/dessaia/pub/Them\\_Seminar2013E.html](http://homeweb1.unifr.ch/dessaia/pub/Them_Seminar2013E.html)  
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### Preliminary discussion:

**Thursday, December 20, 12:45 (Seminar room Math II, Lonza)**