

## Algebraic topology

(Lecture course, summer term 2016)

### Description

Algebraic topology is the study of spaces by algebraic methods. In modern terms it is concerned with constructing *functors* from the *category of spaces* to algebraic categories, most notably *abelian groups*. Developing the necessary machinery is intriguing but instructive because it touches upon various interwoven mathematical fields. The results are rewarding: at the end of the course we have tools at our disposal to distinguish spaces and to predict that certain maps have fixed points. This has some striking and even somewhat amusing consequences: while it is always possible to cut a ham sandwich, whatsoever shaped, into fair parts with a single slice, it is impossible to comb a hairy ball without leaving a cowlick.

### Contents

- Categories, functors, adjunction and limits,
- The fundamental groupoid and van Kampen's theorem,
- Chain complexes and singular homology,
- Cell complexes and cellular homology.

### Recommendations

Participants should have taken the course "Introduction to Geometry and Topology" beforehand.

### Schedule

- Lecture: Tue, 11:30 am–01:00 pm, 20.30 SR 2.058;  
Thu, 11:30 am–01:00 pm, 20.30 SR 0.014;
- Tutorial: Wed, 05:30 pm–07:00 pm, 20.30 SR 2.059;  
(tutor: Jakob Albers)

### References

A. Hatcher, *Algebraic Topology*, Cambridge University Press, 2002  
G. E. Bredon, *Topology and Geometry*, GTM Volume 139, Springer, 1993  
T. tom Dieck, *Algebraic Topology*, EMS Textbooks in Mathematics, 2008  
W. Lück, *Algebraische Topologie: Homologie und Mannigfaltigkeiten*,  
Aufbaukurs Mathematik, Vieweg, 2005