

**Math 595 HAM**  
Homological Algebra  
Fall 2025  
**Ralph M. Kaufmann**

**Course Description:**

Homological algebra is an indispensable tool in many areas of mathematics, such as topology, algebra, algebraic geometry and mathematical physics related to string theory.

We will start with the basic theory of derived functors like Tor and Ext, and then move to localization, roof calculus derived categories and triangulated categories. We will end the regular topics by discussing model categories. If time permits, and depending on the audience, we will treat additional topics like exceptional collections, stability conditions and perverse sheaves. Throughout we will use examples from topology and algebraic geometry. The course will go by its own lecture notes, but the main sources are:

S.I. Gelfand and Yu. I. Manin *Methods of Homological Algebra* Springer 1996

Charles A. Weibel *An introduction to homological algebra*. Cambridge Studies in advanced mathematics. Cambridge University Press 1997.