AB Geometrie und Topologie
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Differentiable manifolds (Differential geometry I)

WiSem 2024/2025

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Differential geometry started out in the 19th century as the study of curved spaces (Gauß, Riemann). In its modern form, it provides a flexible language which allows to capture a wide variety of geometric settings as they arise in many branches of mathematics and physics. To name a few, there is a close interaction of differentiable geometry with topology, (complex) algebraic geometry and geometric analysis, and in physics it is used in mechanics, gauge theory, relativity and string theory.

We will begin with a recapitulation of manifolds, differential forms and Stokes' Theorem as treated in Analysis III. Further topics will be de Rham cohomology and basics of Lie groups.

The course will be continued in the summer term with an introduction to Riemannian geometry.

For students of mathematics or physics, third year or later.

Prerequisites: *Linear Algebra I+II* and *Analysis I-III* (calculus of one and several real variables, measure and integration, basics on manifolds and differential forms). The course will be independent of the course *Geometrie* of the previous semester.

References: L.W. Tu, *An Introduction to manifolds*, Springer, 2008

Th. Bröcker, K. Jänich, *Einführung in die Differentialtopologie*, Springer, 1973

F. Warner, *Foundations of differentiable manifolds and Lie groups*, Springer, 1983

S. Kobayashi, K. Nomizu, *Foundations of differential geometry*, Wiley, 1963