Lecture course Riemannian Geometry II (SP1 Z2):

Lecturer: Thomas Schick

Lectures: Tuesday and Friday 10-12 (planned). 6 credit points, the course will be designed as 3+1 or 2+2 (lecture/exercises)

Assistance: Henry Fischer

Language: English.

Audience: Participants of Riem. Geom. 1. The module works well for M.Sc. students, for B.Sc. students a creative solution still has not been found.

Exam requirements: active participation in the course (no strict formal requirements)

Modules: M.Mat.4613: Aspects of differential geometry; M.Mat.4624: Aspects of groups, geometry and dynamical systems; M.Mat.4615: Aspects of mathematical methods in physics

Description

The course is the continuation of Riemannian geometry I and will built on the latter material. Entering now is possible if the prerequisite knowledge has been obtained in a different way (course taken earlier/elsewhere, independent study...).

The course will explore more of the relations between geometry, in particular curvature, and topology. We will learn about curvature of submanifolds. In particular, we will compare extrinsic and intrinsic curvature and learn the modern version of Gauss’ “Theorema Egregium”. We will also study the intrinsic Riemannian notion of volume and the relation between curvature and volume (Bishop-Gromov inequality). If time permits, we will also cover some aspects of spectral theory of the Laplace operator on a Riemannian manifold and topological consequences. Or we might venture into the concept of “convergence and degeneration” of sequences of Riemannian manifolds and how this can be used to classify and control the set of all (or many) of them.

As goal of the course, the participants will know:

• how a Riemannian metric gives rise to an intrinsic notion of volume and integration
• how the volume is influenced by curvature (and vice versa)
• how one distinguishes intrinsic “curvedness” of a Riemannian manifold from extrinsic “being embedded in a curved way” into another manifold (and Gauss’ revelation that the two notions are related)
• other aspects of how the geometry influences the manifold
Literature


