

Fachseminar *Differentialgeometrie* (Math.)
Seminar *Advanced Differential Geometry 1* (Math.Phys.)

Lorentzian Geometry, Causality and Singularities

summer term 2025

Monday 15:15 – 16:45, A 314 (Augusteum, Math.Dep.)

Start: Monday, April, 7

Please enrol in [Moodle](#)

[students:](#)

(mathematics (Diplom), mathematical physics (M.Sc.)), it is a compulsory elective course in the mathematical physics program (10-MAT-MPDG1).

[Topics:](#)

We discuss models of space times and causality questions. As an application we obtain the singularity theorems by Hawking and Penrose as well as the structure of globally hyperbolic manifolds.

[Reference:](#)

Christian Bär, Lorentzian Geometry, Lecture Notes

<https://www.math.uni-potsdam.de/professuren/geometrie/lehre/lehrmaterialien>

[List of talks:](#)

1. Minkowski space, Section 1.1, pages 1-8
2. De Sitter and Anti-De Sitter space, Section 1.2, 1.3, pages 8-14
3. Robertson-Walker spacetime and the Schwarzschild half-plane, Section 1.4, 1.5, pages 14-21
4. Fundamental notions of causality, Section 2.1, pages 23-34
5. Curve deformation, Section 2.2, pages 35-51
6. Convex sets and quasi-limits, Section 2.3, 2.4, pages 51-60
7. Cauchy hypersurfaces and globally hyperbolic sets, Section 2.5, 2.6, pages 61-72
8. Cauchy developments and horizons, Section 2.7, pages 72-85
9. Singularity theorems by Hawking and Penrose, Section 2.8, 2.9, pages 85-96
10. Globally hyperbolic manifolds, Section 2.10, pages 97-111