

Fachseminar *Differentialgeometrie* (Math.)  
Seminar *New developments in geometry* (Math.Phys.)

## Lorentzian Geometry, Causality and Singularities

winter term 2022/23

Tuesday 11:15 – 12:45, Seminargebäude SG 3-13  
Start: Tuesday, October, 121

Please enrol in [Moodle](#)

### students:

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

### 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/lehmaterialien>

### List of talks:

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