



Universität Hamburg  
DER FORSCHUNG | DER LEHRE | DER BILDUNG

CHAMPP

CENTER IN HAMBURG FOR  
ASTRO-, MATHEMATICAL AND  
PARTICLE PHYSICS

## LECTURE COURSE IN THE QUANTUM UNIVERSE RESEARCH SCHOOL

---

Winter Term 2024/2025

# General Theory of Relativity

G. Moortgat-Pick

### Course Description:

This lecture will provide an introduction to the basics of the theory of general relativity including applications such as black holes and cosmology.

The following topics will be covered:

- recapitulation of the theory of Special Relativity: four-vector formalism, accelerated observers,
- manifolds and curved spaces,
- basics of tensors and differential forms,
- gravitation and Einstein's field equations,
- the Schwarzschild solution and Black Holes,
- gravitational waves,
- cosmology: maximally symmetric spaces and the Friedmann–Robertson–Walker metric.

### Prerequisites:

Knowledge of theoretical physics on the level of a bachelor's degree in physics is strongly recommended. Basic knowledge of special relativity.

### Literature:

B. Bahr, *Tutorium Allgemeine Relativitätstheorie*; T. Fließbach, *Allgemeine Relativitätstheorie*; J.B. Hartle, *Gravity*; C.W. Misner, K.S. Thorne, J.A. Wheeler, *Gravitation*.

**Date and Place:** Wed, 09:15–10:45, 2, Building 2a, Bahrenfeld  
Fri, 09:15–10:45, 2, Building 2a, Bahrenfeld

**Problem Classes:** Mon, 11:15–12:45 and 13:00–14:30, 2, Building 2a, Bahrenfeld

**Starting on:** 16 October 2024

---