

NMA014F, Theory of General Relativity for Mathematicians, 7.5 credits

*Allmän relativitetsteori för matematiker,
7,5 högskolepoäng
Third Cycle/Forskarnivå*

Confirmation

This course syllabus was confirmed by The Research Programmes Board at the Faculty of Science 11 December 2023. The course is in the third cycle and amounts to 7.5 credits.

The course syllabus is formally approved in Swedish. This is a translation.

Learning outcomes

The aim of the course is to give the participant a mathematical presentation of general relativity, that is, spacetime-geometry-based gravitation theory.

On completion of the course, participants shall be able to:

Knowledge and understanding

- Give an account of the field equation, the energy momentum tensor and types of matter distributions
- Describe the tests of general relativity
- Give an account of Schwarzschild black holes and the Friedmann-Lemaître-Robertson-Walker cosmological model
- State definitions and theorems in semi-Riemannian geometry relevant to general relativity

Competence and skills

- Perform local differential geometry calculations
- Derive and solve the geodesic equation for simple spacetimes

Course content

The course will cover the following topics:

- Smooth manifolds
- Tangent and cotangent space
- Tangent and cotangent bundles
- Tensor fields
- Lorentzian manifolds
- Levi-Civita connection
- Parallel transport
- Geodesics
- Curvature
- Minkowski spacetime physics
- Matter
- Field equation
- Black holes
- Cosmology

Forms of instructions

Teaching consists of lectures and problem solving of recommended exercises by the participants.

Forms of assessment

The assessment consists of a written exam.

Grades

Possible grades are Pass and Fail. For a grade of Pass, the student must have passed the written exam.

Language of instruction

The course is given in English.

Necessary prior knowledge

-

Additional information

-