EPFL

PHYS-427 | **Relativity and cosmology I**

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Cursus		Sem.	Type
Ing.-phys		MA1, MA3	Opt.
Physicien		MA1, MA3	Opt.

Language of teaching	English
Credits	6
Session	Winter
Semester	Fall
Exam	Written
Workload	180h
Weeks	14
Hours	**4 weekly**
Lecture	2 weekly
Exercises	2 weekly
Number of positions	

Summary

Introduce the students to general relativity and its classical tests.

Content

Special Relativity (Review):
- Lorentz transformations
- Energy-momentum tensor

General relativity:
- Equivalence principle
- Tensor analysis and physics in curved space-time
- Einstein's equations
- Schwarzschild solution
- Classical tests of Einstein's theory
- Gravitational waves

Learning Prerequisites

Required courses

Analytical mechanics
Classical Electrodynamics

Important concepts to start the course
Special Relativity

Learning Outcomes

By the end of the course, the student must be able to:
- Explain the basic concepts of special and general relativity
- Describe physical phenomena in different coordinate systems
- Compute Christofell symbols and curvatures from a given line element
- Solve Einstein's field equations for static spherically symmetric problems

• Explain the observational effects at the scale of the Solar System that cannot be described by Newtonian gravity

Teaching methods

Ex cathedra and exercices in classroom

Assessment methods

final written exam

Supervision

Office hours   Yes
Assistants   Yes
Forum   Yes

Resources

Bibliography

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Ressources en bibliothèque

• Gravitation and Cosmology / Weinberg
• Gravitation / Mizner
• The classical theory of fields / Landau
• Spacetime and Geometry: an Introduction to General Relativity / Carroll
• A First Course in General Relativity / Schutz
• General relativity / Wald

Moodle Link

• https://go.epfl.ch/PHYS-427