

PHYS-427

**Relativity and cosmology I**

Sibiriyakov Sergey

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

Language of teaching	English
Credits	5
Session	Winter
Semester	Fall
Exam	Oral
Workload	150h
Weeks	14
<b>Hours</b>	<b>4 weekly</b>
Courses	2 weekly
Exercises	2 weekly
<b>Number of positions</b>	

**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

**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 Christoffel 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 exam 100%

### Supervision

Office hours	Yes
Assistants	No

### Resources

#### Bibliography

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#### Ressources en bibliothèque

- [Gravitation and Cosmology / Weinberg](#)
- [The classical theory of fields / Landau](#)
- [Gravitation / Mizner](#)

#### Moodle Link

- <http://moodle.epfl.ch/course/view.php?id=14022>