

PHYS-415

Particle physics I

Marchevski Radoslav

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

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	Oral
Workload	120h
Weeks	14
Hours	4 weekly
Lecture	2 weekly
Exercises	2 weekly
Number of positions	

Summary

Presentation of particle properties, their symmetries and interactions. Introduction to quantum electrodynamics and to the Feynman rules.

Content**Introduction:**

The Standard Model, a step toward Grand Unification.
Particle detection, accelerators.
Relativity, Klein-Gordon and Dirac equations.

Properties of particles:

Mass, charge, lifetime, spin, magnetic moment,...

Symmetries, conservation laws, and the quark model:

Invariance under space translation and rotation, parity, time reversal and charge conjugation. Violation of parity and CP, CPT theorem. Isospin.

QED:

Introduction to QED. Feynman rules. The form factors.

Tests of QED:

Electron-positron annihilation. Electron-proton scattering. Deep inelastic scattering and proton substructure. Electron and muon magnetic moments.

Learning Prerequisites**Recommended courses**

Nuclear and Particle Physics I and II, Quantum mechanics I and II

Learning Outcomes

By the end of the course, the student must be able to:

- Analyze sub-microscopical phenomena

Teaching methods

Ex cathedra and exercises in class

Assessment methods

written exam at the end of the semester (50%) + oral exam during exam session (50%)

Supervision

Assistants Yes

Resources

Bibliography

Mark Thomson, "Modern Particle Physics" (2013)

Ressources en bibliothèque

- [Mark Thomson, "Modern Particle Physics" \(2013\)](#)

Websites

- <http://pdg.lbl.gov/>

Moodle Link

- <https://go.epfl.ch/PHYS-415>