PHYS-415 **Particle physics I**

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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

oral exam (100%)

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