

PHYS-415

Particle physics I

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

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|----------------------------|-----------------|
| 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>