PHYS-471 **Particle physics: the flavour frontiers**

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Cursus	Sem.	Type
Ing.-phys	MA2, MA4	Opt.
Physicien	MA2, MA4	Opt.

Language of teaching	English
Credits	4
Session	Summer
Semester	Spring
Exam	Oral
Workload	120h
Weeks	14
Hours	**4 weekly**
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Summary

This course will present experimental aspects of flavour physics primarily in the quark sector but also in the lepton sector and their role in the development of the Standard Model of particle physics.

Content

Important historical developments will be discussed, including key flavour physics observables and past experiment built to measure them. The course will delve into present state-of-the-art research and its unresolved problems and will discuss possible ways to address them at present and future flavour physics experiments.

Introduction
key theoretical concepts: the Standard Model, weak interactions, the Yukawa sector, quark-mixing matrix, Unitarity triangles, CP violation
Experimental aspects of flavour physics
past and present flavour-physics facilities and experiments, particle production at accelerators, main experimental principles
Flavour physics in the quark sector
meson decays, neutral meson oscillations, measurements of the angles of the Unitarity triangle, CP violation in meson decays, rare decays of K, B, and D mesons,
Test of the standard model and beyond
CKM fits, New physics flavour puzzle, Lepton Flavour Universality tests, charged lepton flavour violation

Keywords

flavour physics, particle physics, quark mixing, CP violation, meson decays

Learning Prerequisites

Recommended courses

Nuclear and Particle Physics I and II, Quantum mechanics I and II, Particle Physics I. Quantum Field Theory I is also recommended.

Learning Outcomes

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

- Analyze the sub-atomic physical phenomena
- Elaborate on modern experimental methods in flavour physics

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

Sozzi: Discrete symmetries and CP violation (oriented towards experiment)
Sanda and Bigi: CP violation (oriented towards theory and phenomenology)
Yuval Grossman, Philip Tanedo:Lectures on flavour physics (oriented towards theory)

Ressources en bibliothèque

- Lectures on flavour physics / Grossman Tanedo [arXiv]
- Discrete symmetries and CP violation / Sozzi
- CP violation / Sanda & Bigi

Websites

- https://pdg.lbl.gov/