

PHYS-741

**Gauge Theories and the Standard Model**

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Cursus	Sem.	Type
Physics		Obl.

Language of teaching	English
Credits	4
Session	
Exam	Multiple
Workload	120h
<b>Hours</b>	<b>56</b>
Courses	28
Exercises	28
<b>Number of positions</b>	

**Frequency**

Every year

**Remark**

Every year / Next time: Fall 2018

**Summary**

The goal of this course is to explain the conceptual and mathematical bases of the Standard Model of fundamental interactions and to illustrate in detail its phenomenological consequences.

**Content**

- Introduction to non-abelian gauge theories
  
- Higgs mechanism and massive gauge theories
  
- The Standard Model:
  1. From Fermi theory to the development of the Standard Model (SM)
  2. The structure of the SM: multiplet content and anomaly cancellation
  3. Mass generation, Flavor and discrete symmetries (C,P,T)
  4. Quantum Chromodynamics (basics)
  5. Tests of the SM: flavor and electroweak precision measurements
- Open questions and an overview on what may lie ahead: hierarchy problem, dark matter, unification

**Keywords**

fundamental interactions, particle phenomenology  
gauge theories, Higgs mechanism,

**Learning Prerequisites****Required courses**

Relativistic Quantum Fields I et II, Advanced Quantum Mechanics,  
Advanced Quantum Field Theory,

**Recommended courses**

General Relativity, Cosmology

**Expected student activities**

Develop a conceptually and mathematically accurate picture of the theory of fundamental interactions. Understand how the structure of the Standard Model follows from basic principles, critically appreciate its phenomenological adequacy and the questions it leaves open.

**Resources****Bibliography**

M. Peskin and Daniel Schroeder, An Introduction to Quantum Field Theory  
S. Weinberg, Quantum Field Theory, Volumes I and II  
R. Barbieri, Ten Lectures on the ElectroWeak Interactions

**Références suggérées par la bibliothèque**

- [The quantum theory of fields / Weinberg . Vol1](#)
- [The quantum theory of fields / Weinberg . Vol2](#)
- [An introduction to Quantum Field Theory / Peskin, Schroeder](#)
- [Lectures on the electroweak Interactions / Barbieri](#)