PHYS-702

Advanced Quantum Field Theory

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Cursus	Sem.	Type
Physics		Opt.

Language of teaching	English
Credits	4
Session	
Exam	Multiple
Workload	120h
Hours	**56**
Lecture	28
Exercises	28
Number of positions	

Frequency

Every year

Remark

Next time: Fall

Summary

The course builds on the two previous courses on the subject. The main subject is the study of quantum field theories at the loop level. The course introduces the concept of loop divergences and renormalization. Non abelian gauge theories are also discussed in depth.

Content

Skills developed in the course include the use of the Path integral formalism, methodologies to perform loop calculations and renormalization.
1) Path integral approach to QFT
2) Regularization and renormalization

- applications to scalar fields with a quartic interaction
- application to Yukawa theory
- application to Quantum Electrodynamics

3) Non-abelian gauge theories

- BRST quantization
- renormalization at 1- loop

4) The renormalization group

- Callan Symanzik equation
- asymptotic freedom
- fixed points

5) Anomalies

Keywords

Path integral formalism, divergences renormalization, Gauge theories
Renormalization group, Anomalies

Learning Prerequisites

Required courses

Quantum mechanics 1,2 - Quantum Field theory 1,2

Recommended courses

Conformal Field theory and gravity
Gauge theories and the Standard Model

Expected student activities

Study a quantum field theory at quantum level.
Understanding and interpreting loop effects in a quantum field theory.
Performing loop calculations in gauge theories.

Resources

Bibliography

An introduction to Quantum Field Theory, by Peskin and Schroeder
The quantum theory of Fields, Vol 1,2 by Weinberg

Ressources en bibliothèque

- An introduction to Quantum Field Theory / Peskin, Schroeder
- The quantum theory of fields / Weinberg . Vol1
- The quantum theory of fields / Weinberg . Vol2