2025

Quantum Field Theory (NWI-NM040B)

General information

Course ID
NWI-NM040B

Credits
6 EC

Period(s)

- Period 1 until Period 2 (01-09-2025 until 25-01-2026)

Category
Master

Instruction language
English

Offered by
Radboud University - Faculty of Science - Wiskunde, Natuur- en Sterrenkunde - - - -

Lecturers

Contactperson for the course

- prof. dr. W.J.P. Beenakker

Coordinator

- prof. dr. W.J.P. Beenakker

Examiner

- prof. dr. W.J.P. Beenakker

Lecturer

- prof. dr. W.J.P. Beenakker

Start courses and course registration

OSIRIS Student
You can register yourself via OSIRIS Student. To do so, go to Enroll / Course.

Enrolment periods

- Period 1 until Period 2

  Enrolment period

  1 July 2025 until 5 September 2025 23:59

  Unenrolment

  until 2 November 2025 23:59

  Period of education

  1 september 2025 until 25 januari 2026

Course details

Content

This course provides an introduction to the modern concepts of quantum field theory, formulated in the canonical framework. Special attention is devoted to the explicit calculation of physical observables, like scattering cross-sections and decay widths. It is shown how such calculations can be performed within perturbation theory by employing Feynman rules. The resulting higher-order perturbative corrections turn out to be infinite and therefore require a careful treatment. In this context it will be investigated whether the predictive power of the theory can be restored if the infinities are regularized properly.

A further aim of the course is to introduce the concept of local gauge symmetries, which plays a crucial role in the description of the interactions between fundamental particles. As an example it is shown how the electromagnetic interactions can be described by invoking the gauge principle and how the corresponding gauge symmetry enables us to get a handle on the infinities of the perturbative corrections.

Instructional Modes
lectures and exercise classes

Aims

- The student has a good understanding of the fundamental aspects of quantum field theory in the canonical formulation
- The student is able to derive and use Feynman rules
- The student is familiar with the salient details of calculating radiative corrections within perturbation theory
- The student is familiar with the concept of gauge symmetries and its implications

Level

Basic-level course for students who are interested in theoretical particle physics and quantum gravity.
The course is also of interest to students who are interested in experimental particle physics and want to obtain a solid theoretical background.

Presumed foreknowledge

Bachelor courses on Quantum Mechanics

Test information

Written exam

Instructional modes

Instructional modes

- Course

Tests

Tests

- Exam
  Exam

  Test weight
  1

Materials

Required material

- Book
  Michael E. Peskin and Daniel V. Schroeder, An introduction to Quantum Field Theory, Westview Press 1995, 1st Edition