

Electroweak and Strong Force (C003211)

Course size *(nominal values; actual values may depend on programme)*

Credits 6.0

Study time 180 h

Course offerings in academic year 2026-2027

A (semester 2)

English

Gent

Lecturers in academic year 2026-2027

Sevrin, Alexandre

VUB

lecturer-in-charge

Offered in the following programmes in 2026-2027

[Master of Science in Physics and Astronomy](#)

crdts

6

offering

A

Teaching languages

English

Keywords

Electromagnetism, strong and weak forces

Position of the course

Contents

- Chiral interactions
- Non-abelian gauge theories
- The Brout-Englert-Higgs mechanism
- The electroweak interactions as a spontaneously broken, chiral $SU(2) \times U(1)$ gauge theory
- The strong force as an $SU(3)$ gauge theory
- Masses and the CKM matrix
- Majorana and Dirac masses, masses for neutrinos
- Introduction to regularization and renormalization, the running of coupling constants
- Introduction to grand unified theories
- Introduction to supersymmetry

Initial competences

A reasonable understanding of relativistic quantum field theory, in particular quantum electrodynamics is needed. As a guideline the student should master the material covered in the first eight chapters of "Quantum Field Theory" by F. Mandl and G. Shaw (or equivalent).

Final competences

A microscopic understanding of the electroweak and the strong force through their description in terms of spontaneously broken (non-)abelian gauge theories.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Seminar, Lecture

Study material

None

References

Course content-related study coaching

Assessment moments

end-of-term and continuous assessment

Examination methods in case of periodic assessment during the first examination period

Oral assessment

Examination methods in case of periodic assessment during the second examination period

Oral assessment

Examination methods in case of permanent assessment

Assignment

Possibilities of retake in case of permanent assessment

examination during the second examination period is possible in modified form

Calculation of the examination mark

The homework assignments and paper forms both 25 % of the final score. The exam (50%) itself will consist of two applications which after working out will be orally discussed with the examiner.

1/4 homework, 1/4 paper, 1/2 exam