

## 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 2024-2025**

A (semester 2)

English

Gent

**Lecturers in academic year 2024-2025**

Sevrin, Alexandre

VUB

lecturer-in-charge

**Offered in the following programmes in 2024-2025**

[Master of Science in Teaching in Science and Technology\(main subject Physics and Astronomy\)](#)

**crdts**

**offering**

6

A

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

6

A

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

6

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 electro dynamics 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