

PHYS-432

Quantum field theory II

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Cursus	Sem.	Type
Ing.-phys	MA2, MA4	Opt.
Physicien	MA2, MA4	Opt.

Language of teaching	English
Credits	5
Session	Summer
Semester	Spring
Exam	Oral
Workload	150h
Weeks	14
Hours	4 weekly
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Summary

The goal of the course is to introduce relativistic quantum field theory as the conceptual and mathematical framework describing fundamental interactions.

Content

6. Gauge invariance, the electromagnetic field and its coupling to charged fields. Quantized electromagnetic field. Massive vector field.

7. Discrete symmetries: P, C, T and CPT.

8. Interacting fields. Formal theory of relativistic scattering. Asymptotic states. Lippmann-Schwinger equation. S-matrix and its symmetries. S-matrix in perturbation theory and Feynman diagrams. Cross sections and decay-rates.

9. Fundamental interactions. Quantum electrodynamics. Electroweak interactions and the Higgs mechanism. Parity violation.

Learning Prerequisites**Required courses**

Classical Electrodynamics, Quantum Mechanics I and II, Analytical Mechanics

Recommended courses

Mathematical Physics

Learning Outcomes

By the end of the course, the student must be able to:

- Expound the theory and its phenomenological consequences
- Formalize and solve the problems

Transversal skills

- Use a work methodology appropriate to the task.

Teaching methods

Ex cathedra and exercises in class

Assessment methods

Exam: oral, consisting of one theoretical question and one exercise, picked randomly and for which the candidate is allowed a 30 minute preparation

Resources

Bibliography

- "An introduction to quantum field theory / Michael E. Peskin, Daniel V. Schroeder". Année:1995. ISBN:0-201-50397-2
- "The quantum theory of fields / Steven Weinberg". Année:2005. ISBN:978-0-521-67053-1
- "Quantum field theory / Claude Itzykson, Jean-Bernard Zuber". Année:1980. ISBN:0-07-032071-3
- "Relativistic quantum mechanics / James D. Bjorken, Sidney D. Drell". Année:1964
- "A modern introduction to quantum field theory / Michele Maggiore". Année:2010. ISBN:978-0-19-852074-0
- "Théorie quantique des champs / Jean-Pierre Derendinger". Année:2001. ISBN:2-88074-491-1

Ressources en bibliothèque

- [An Introduction to Quantum Field Theory / Peskin](#)
- [The Quantum Theory of Fields/ Weinberg](#)
- [Quantum Field Theory / Itzykson](#)
- [Relativistic Quantum Mechanics / Drell](#)
- [A Modern Introduction to Quantum Field Theory / Maggiore](#)
- [Théorie quantique des champs / Derendinger](#)
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Websites

- <https://ltp.epfl.ch/files/content/sites/ltp/files/Files/LectureNotes/Quantum%20Field%20Theory>

Moodle Link

- <https://moodle.epfl.ch/course/view.php?id=14987>

Prerequisite for

Prerequisite for Theoretical Physics