PHYS-757

Axiomatic Quantum Field Theory

Bossoney Simon

Cursus	Sem.	Type
Physics		Opt.

Language of teaching	English
Credits	1
Session	
Exam	Oral
Workload	30h
Hours	**16**
Courses	12
Exercises	4
Number of positions	

Frequency

Every year

Remark

Postponed to Fall 2023

Summary

Presentation of Wightman's axiomatic framework to QFT as well as to the necessary mathematical objects to their understanding (Hilbert analysis, distributions, group representations,...). Proofs of the main mathematical consequences (CPT, spin-statistics, Reeh-Schlieder, Haag no-go).

Content

Week 1:

Poincaré group. Lie algebra. Casimir invariants. Finite dimensional representations. Spinors. Unitary representations. Axiom W0

Week 2:

(Tempered) distributions. Definitions and their topology. Representations. convolution and Fourier transforms of distributions.
Fourier-Laplace transforms. Extension on analytical tubes. Edge-of-the-wedge theorem.
Extended tubes. Invariance under complex Poincaré group.

Week3:

Axioms W1-W3. Analytical aspects of Wightman functions. Reconstruction-, Reeh-Schlider-, CPT- and spin & statistics theorems.

Week 4:

Haag's no-go theorem and his versions. Haag-Ruelle scattering theory. Asymptotic completeness. S-matrix.
The students will be invited to prove some aspects themselves during the exercises. They are hence expected to have followed
successfully all proposed mathematical option courses as well as lectures in QFT or QED of the masters curriculum.

Keywords

QFT, distributions, Poincaré group, Wightman n-pont functions.

Learning Prerequisites

Required courses

Quantum Mechanics 1-IV, QFT, Functionnal analysis

Learning Outcomes

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

- To have a mathematical rigourous understanding of the foundations of QFT

Resources

Bibliography

Streater & Wightman: "PCT, Spin, statistics and all that », Bogolubov & Logunov « General Principles of QFT"

Ressources en bibliothèque

- Streater & Wightman: "PCT, Spin, statistics and all that »
- Bogolubov & Logunov « General Principles of QFT"