

PHYS-621

Introduction to conformal field theory

Invited lecturers (see below), Trevisani Emilio

Cursus	Sem.	Type
Physics		Opt.

Language of teaching	English
Credits	2
Session	
Exam	Oral
Workload	60h
Hours	28
Courses	14
Exercises	14
Number of positions	

Frequency

Every year

Summary

Introduction to conformal field theory in higher dimensions, covering topics such as phase transitions, renormalization group, critical exponents, conformal symmetry, radial quantization, unitarity, operator product expansion, and introducing the principles of the conformal bootstrap.

Content

This course offers an introduction to conformal field theory (CFT) in dimensions higher than two.

We start by exploring continuous phase transitions in statistical physics, using the Ising model in d dimensions as a prototypical example. We'll discuss how the renormalization group (RG) flow leads to scale (and conformal) invariance at large distances and demonstrate how critical exponents are related to the scaling dimensions of operators.

Next, we explore the foundations of CFTs. We begin by analyzing conformal symmetry, examining both finite and infinitesimal transformations, the algebra, and how it can be generated from the stress tensor. We'll explore how this symmetry constrains the kinematics of correlation functions. Moving on, we cover the quantization of the theory and show how radial quantization provides a correspondence between states and operators. We also discuss unitarity/reflection positivity and cover the operator product expansion (OPE). The course concludes with an explanation of how, by combining the concepts introduced, one can compute the critical exponents of a CFT such as the 3d Ising model using the conformal bootstrap.

Keywords

CFT, phase transitions, renormalization group, conformal bootstrap

Learning Prerequisites**Recommended courses**

A basic knowledge of quantum field theory and statistical physics is recommended.

Learning Outcomes

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

- Understand the basics of RG, CFT, and conformal bootstrap and their role in critical phenomena.

Resources**Bibliography**

Scaling and Renormalization in Statistical Physics (Cardy), TASI Lectures on the Conformal Bootstrap (Simmons-Duffin), EPFL Lectures on Conformal Field Theory in $D \geq 3$ (Rychkov)

Ressources en bibliothèque

- [Scaling and renormalization in statistical physics / Cardy](#)
- [The Conformal Bootstrap / Simmons-Duffin](#)
- [EPFL Lectures on Conformal Field Theory in \$D \geq 3\$ / Rychkov](#)

Références suggérées par la bibliothèque

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Moodle Link

- <https://go.epfl.ch/PHYS-621>