PHYS-739

Conformal Field theory and Gravity

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Cursus	Sem.	Type
Physics		Opt.

Language of teaching	English
Credits	4
Session	
Exam	Oral
Workload	120h
Hours	**56**
Lecture	28
Exercises	28
Number of positions	

Frequency

Every year

Remark

Next time: Fall

Summary

This course is an introduction to the non-perturbative bootstrap approach to Conformal Field Theory and to the Gauge/Gravity duality, emphasizing the fruitful interplay between these two ideas.

Content

1. Conformal field theory - Conformal transformations, conformal algebra, local operators (primaries and descendants), correlation functions, stress tensor, Weyl invariance, conformal Ward identities, Radial quantization (state-operator map), unitarity bounds, operator product expansion, conformal blocks (Casimir equation), conformal bootstrap, conformal anomaly, embedding space formalism, large N factorization.

2. Anti-de Sitter spacetime - Geometry, particle dynamics, free fields in AdS, interacting fields in AdS.

3. The AdS/CFT correspondence - quantum gravity as CFT, semi-classical limit and the large N expansion, the role of String Theory, black holes and thermodynamics, universal long range forces, entanglement entropy.

Note

Invited lecturer: Monica Guica

Keywords

gauge/gravity duality
conformal bootstrap

Learning Prerequisites

Required courses

Quantum Field Theory, General Relativity

Recommended courses

Advanced Quantum Field Theory
Gauge Theories and the Standard Model

Learning Outcomes

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

- Understand the Conformal Bootstrap approach to Conformal Field Theory
- Understand the AdS/CFT correspondence and its implications for Quantum Gravity
- Apply Perform and explain calculations in CFT and Gravity

Teaching methods

Black board lectures and problem solving sessions.

Expected student activities

Attendance of lectures and problem solving sessions. Critical study of the material.

Assessment methods

Indicidual project and oral exam.

Resources

Bibliography

Slava Rychkov, lectures notes on CFT, http://arxiv.org/abs/1601.05000
David Simmos-Duffin, lecture notes on CFT, http://arxiv.org/abs/1602.07982
Joao Penedones, lecture notes on AdS/CFT, https://arxiv.org/abs/1608.04948

Moodle Link

- https://go.epfl.ch/PHYS-739