EPFL

MATH-605 **Conformal bootstrap and Liouville conformal field**
Invited professor(s)

Cursus	Sem.	Type
Mathematics		Obl.

Language of teaching	English
Credits	2
Session	
Exam	Oral
Workload	60h
Hours	**40**
Courses	16
Exercises	4
TP	20
Number of positions	

Frequency

Only this year

Remark

The dates will be 5/10, 12/10, 19/10, 16/11, 23/11, 30/11, 7/12, 14/12.

Summary

The course will focus on a probabilistic construction of a conformal field theory related to random Riemann surfaces, called the Liouville conformal field theory. The symmetries of the theory allow to express the n-point correlation functions in terms of 3-points correlation functions on S^2.

Content

The Liouville CFT in dimension 2 has been constructed using probability by David-Kupiainen-Rhodes-Vargas on the Riemann sphere in 2014. This is a field theory of random surfaces. The Gaussian multiplicated chaos and the Gaussian Free Field are fundamental tools to define it. This has been extended on Riemann surface by Guillarmou-Rhodes-Vargas.

We will first explain how to make the construction of correlation functions on general Riemann surfaces. In a second time, we will put the CFT into a setup closer to Segal's approach of conformal field theory, which is a very beautiful and intuitive approach based on associating a Hilbert space to the unit circle, and an element (called amplitude) in the tensor product of Hilbert spaces to Riemann surfaces with boundary (the boundary is a collection of circles and the Riemann surface can be viewed as a space time interpolating between them).

We will then explain how to compute correlation functions on surfaces (including the sphere) by splitting the surfaces into geometric building blocks and writing the correlation functions as scalar products (in the Hilbert space) of amplitudes of the building blocks. Using the conformal symmetries of the problem we will find a particular eigenbasis of the Hilbert space associated to a certain operator, allowing then to get explicit formulas for the correlation functions in terms of 3-point structure constants on the sphere. This is called the conformal bootstrap method, which is very important in the study of conformal field theory in physics.

Learning Prerequisites

Required courses

Basic knowledges of probablity, Riemannian geometry and functional analysis are required.