Tensor Models and Holography

Rapport sur les contributions

https://indico.math.cnrs.fr/e/7540

ID de Contribution: **1** Type: **Non spécifié**

Welcome address

lundi 6 février 2023 09:20 (10 minutes)

ID de Contribution: **2** Type: **Non spécifié**

Emergent Gravity, hidden sectors and TT Deformations

lundi 6 février 2023 11:00 (1 heure)

We investigate emergent gravity extending the paradigm of the AdS/CFT correspondence. The emergent graviton is associated to the (dynamical) expectation value of the energy-momentum tensor. We derive the general effective description of such dynamics, and apply it to the case where a hidden theory generates gravity that is coupled to the Standard Model. In the linearized description, generically, such gravity is (effectively) massive with the presence of an extra scalar degree of freedom. The propagators of both the spin-two and spin-zero modes are positive and well defined. The associated emergent gravitational theory is a bi-gravity theory, as is (secretly) the case in holography. The background metric on which the QFTs are defined, plays the role of dark energy and the emergent theory has always as a solution the original background (flat) metric. In the case where the hidden theory is holographic, the overall description yields a higher-dimensional bulk theory coupled to a brane. The effective graviton on the brane has four-dimensional characteristics both in the UV and IR and is always massive. The setup realizes the self-tuning mechanism of the cosmological constant.

Orateur: KIRITSIS, Elias (APC and University of Crete)

ID de Contribution: **3** Type: **Non spécifié**

Jackiw-Teitelboim Quantum Gravity from First Principles

lundi 6 février 2023 09:30 (1 heure)

Orateur: FERRARI, Frank (Université Libre de Bruxelles and International Solvay Institutes)

ID de Contribution: **4** Type: **Non spécifié**

Thermodynamics and conformal operators of the Sachdev-Ye-Kitaev model [IN REMOTE]

lundi 6 février 2023 14:30 (1 heure)

Quantum mechanical models with random interactions have an infinite number of bilinear operators,
the scaling dimensions of which can be computed explicitly in the large N limit.
The lowest dimension operators play an important role in thermodynamical
properties of these models and define the behavior of various
correlation functions in the infrared limit.
In this talk I'll discuss effects of these operators on the SYK model free-energy
and its numerical observation.

Orateur: TARNOPOLSKY, Grigory

ID de Contribution: **5** Type: **Non spécifié**

Group Invariant States as Quantum Many-Body Scars [IN REMOTE]

lundi 6 février 2023 16:00 (1 heure)

Orateur: KLEBANOV, Igor

ID de Contribution: **6** Type: **Non spécifié**

Holography of Information in AdS/CFT

mardi 7 février 2023 09:30 (1 heure)

The principle of the holography of information states that in a theory of quantum gravity a copy of all the information available on a Cauchy slice is also available near the boundary of the Cauchy slice. This redundancy in the theory is already present at low energy. In the context of the AdS/CFT correspondence, this principle can be translated into a statement about the dual conformal field theory. We carry out this translation and demonstrate that the principle of the holography of information holds in the setting of the duality between the free O(N) vector model and higher spin gravity.

Orateur: DE MELLO KOCH, Robert

ID de Contribution: **7** Type: **Non spécifié**

Higher-spin gravity in two dimensions

mardi 7 février 2023 11:00 (1 heure)

A non-abelian higher-spin theory in two dimensions is proposed, describing an infinite multiplet of massive scalar fields, with fine-tuned masses, interacting with infinitely many topological gauge fields together with their dilaton-like partners. The corresponding action functional is of BF-type and generalizes the known higher-spin extension of Jackiw-Teitelboim gravity. Finally, we discuss the holographic CFT1 duals of the kinematical structures identified in the AdS2 bulk.

Orateur: BEKAERT, Xavier (Université de Tours)

ID de Contribution: **8** Type: **Non spécifié**

From JT to 3d pure gravity

mardi 7 février 2023 14:30 (1 heure)

Taking inspiration from our understanding of 2d JT gravity, we develop aspects of 3d pure gravity. In particular, we propose an effective model of 3d pure gravity and discuss its factorization across entangling surfaces. Finally, we highlight some differences between gravity in its metric formulation and its first order gauge theoretic formulation, focussing on the underlying algebraic structure. Largely based on arXiv:2210.14196 and the earlier JT story in arXiv:1812.00918.

Orateur: MERTENS, Thomas (Ghent University)

ID de Contribution: **9** Type: **Non spécifié**

Differential Equations for the Distribution of Ground States in JT gravity [IN REMOTE]

mardi 7 février 2023 16:00 (1 heure)

Orateur: JOHNSON, Clifford

ID de Contribution: **10** Type: **Non spécifié**

Old and new on the O(N)^3 tensor field theory

mercredi 8 février 2023 09:30 (1 heure)

The O(N)^3 model is one of the most studied tensor field theories with numerous interesting regimes and non trivial features. Its interest resides in the promise that one can use it as a playground for studying strongly interacting field theories. In this talk I will present a personal selection of (old, new and brand new) results on this model.

Orateur: GURAU, Razvan

ID de Contribution: **11** Type: **Non spécifié**

Double scaling limits of various tensor models (the O(N)^3-invariant tensor model and a couple more)

mercredi 8 février 2023 11:00 (1 heure)

One of the most celebrated tools in the study of matrix models is the double scaling limit mechanism (known to be related to the continuuos limit of these models).
In this talk I will first exhibit the implementation of the double scaling limit mechanism for various quartic tensor models, such as the multi-orientable tensor model and the $O(N)^3$-invariant tensor model. In the last part of the talk I will present how this approach generalizes for a sextic tensor model, the so-called prismatic tensor model.

Orateur: TANASA, Adrian (Univ. Bordeaux)

ID de Contribution: **12** Type: **Non spécifié**

Conditions for existence of islands of entanglement

In the last few years there has been considerable interest in the use of islands of entanglement to explain the recover of information during black hole evaporation. Many toy models for these phenomena use two-dimensional JT gravity, which should be dual to a one-dimensional theory with SYK type features. In this talk we will explore the emergence of islands in higher dimensions, analaysing the necessary conditions for the existence of an island.

Orateur: TAYLOR, Marika (University of Southampton)

ID de Contribution: **13** Type: **Non spécifié**

Effective low-temperature holographic theories

jeudi 9 février 2023 11:00 (1 heure)

Gauge/gravity duality allows us to construct exact renormalization group flows (sometimes only numerically) by turning on relevant deformations of ultraviolet conformal field theories with a gravitational dual. However, identifying the corresponding effective degrees of freedom at low temperatures and writing down an effective theory for them remains a non-trivial task. I will describe recent progress in this direction on RG flows with emergent Lorentz invariance, and finish with some comments on how this could shed light on the case of spacetimes with an emergent AdS2 factor, which are dual to higher-dimensional extensions of the SYK model.

Orateur: GOUTÉRAUX, Blaise (Ecole Polytechnique)

ID de Contribution: **14** Type: **Non spécifié**

An application of melonic CFTs: The F-theorem

jeudi 9 février 2023 14:30 (1 heure)

According to the F-theorem, the free energy on the sphere for a three-dimensional CFT decreases along the renormalization group flow. I will present here a generalization of this theorem to the long-range bosonic O(N)^3 tensor model. This model is a melonic CFT which displays four lines of fixed points at large N, parametrized by a purely imaginary coupling. It was non-trivial to show that the F-theorem is satisfied by this model as it was proven for unitary CFTs while the long-range O(N)^3 model presents only hints of unitarity at large N.
In the first part of the talk, I will explain how to put a CFT on the sphere and will present a simple example via a flow between two gaussian CFTs. In the second part of the talk, I will quickly review the key features of the long-range O(N)^3 model and then show that it indeed satisfies the F-theorem. As an added bonus, we show how an infinite series of ladder diagrams can be resumed using conformal partial wave expansion.

Orateur: HARRIBEY, Sabine (CPHT Ecole Polytechnique - Heidelberg University)

ID de Contribution: **15** Type: **Non spécifié**

SYK and turbulence [IN REMOTE]

jeudi 9 février 2023 16:00 (1 heure)

Orateur: ROSENHAUS, Vladimir

ID de Contribution: **16** Type: **Non spécifié**

Knot, matrix and tensor models…melon or meron?

jeudi 9 février 2023 09:30 (1 heure)

The Gaussian mean of $N \times N$ Hermitian matrix provides a knot configuration
in the replica limit N to 0 (arXiv:2301.06003). The classical knot is related to
Chern-Simons gauge theory, which shows two edges
of Seifert surface are bounded, similar to two merons bounded into instanton.
Higher dimensional knot (2-knot) consists of double Chern-Simons gauge field, which leads to Regge 6-j symbols
tensor model for 3d gravity. We discuss the relation between the intersection numbers of p-spin curves and the quantum knots.
The 4 dimensional Chern-Simons N=2 Yang Mills has an instanton, described by Nekrasov integral, which is akin to the replica formula for the intersection theory.

Orateur: HIKAMI, Shinobu (OIST)

ID de Contribution: **17** Type: **Non spécifié**

Random Tensors, Loop Vertex Expansion and Their Cumulants

vendredi 10 février 2023 11:00 (1 heure)

In the first part of my talk I shall present some generalities about random tensor models in relation with quantum gravity. In the second part I introduce the loop vertex expansion which is a technique of constructive field theory. In the third part I construct cumulants of a $U(N)$ vector model perturbed by a quartic term. This model has a non-trivial covariance to allow for renormalisation, but is one the simplest models one could think of, because its renormalization is limited to tadpoles. Nevertheless it requires a different technique, the multi-scale loop vertex expansion, and for cumulants it has never been done. I prove their Borel summability in a cardioid of the associated coupling constant.

Orateur: RIVASSEAU, Vincent (Université Paris-Saclay)

ID de Contribution: **18** Type: **Non spécifié**

Partition algebras and large N permutation symmetry in matrix quantum mechanics

vendredi 10 février 2023 09:30 (1 heure)

Algebraic techniques based on Schur-Weyl duality have played an important role in the combinatorics of observables and correlators in single and multi-matrix models, of relevance to the AdS/CFT holographic dictionary. These techniques have recently been applied to study the implications of manifest permutation symmetry, for the state space and dynamics of quantum mechanical systems of matrices of general size N. The results include a solvable 11-parameter generalisation of the standard matrix harmonic oscillator. The permutation invariant sector of the Hilbert space, for general Hamiltonians, can be described using partition algebra diagrams forming the bases of a tower of partition algebras Pk(N). The integer k is interpreted as the degree of matrix oscillator polynomials in the quantum mechanics. Algebraic Hamiltonians with large ground state degeneracies can be engineered using the partition algebras. Models of quantum many-body scars are also constructed in this framework. The talk will be based on the paper https://arxiv.org/abs/2207.02166

Orateur: RAMGOOLAM, Sanjaye