Marc HENNEAUX

CHAIRE CHAMPS, CORDES ET GRAVITÉ

# *Topics in Quantum Gravity*

COLLOQUE JUNE 20 - 21th, 2024

Collège
DE FRANCE
—1530—

20 & 21 JUIN 2024

# *Topics in Quantum Gravity*

COLLOQUE EN ANGLAIS

Amphithéâtre Maurice Halbwachs, Site Marcelin Berthelot.

The workshop "Topics in Quantum Gravity" will present recent advances in quantum field theory, strings and quantum gravity. The topics covered in the workshop will range from supersymmetric field theories, non-invertible symmetries, black hole information paradox, celestial holography, 2D gravity and spacetime singularities.

The workshop will be followed by the annual ENS Summer Program, which will take place at the Ecole Normale Supérieure from June 22 through June 28,

https://indico.in2p3.fr/event/32058/

**10:30 - 11:00** – Welcome coffee

**11:00 - 12:00**
**Miguel Montero** (IFT, Universidad Autónoma de Madrid, Spain)
*No global symmetries and string universality*

Abstract: The Swampland Program aims to uncover general principles that govern the consistent coupling of low-energy EFT's to gravity. These constraints can be significanlty strengthened when combined with supersymmetry. I will review recent progress in this question, focused on the "no global symmetries" Swampland conjecture, reviewing some of its implications and describing recent work on its extension to non-invertible symmetries and applications to exotic super-gravities in 6 dimensions.

**12:00 - 14:00** – Lunch break

**14:00 - 15:00**
**Thomas Mertens** (University of Ghent, Belgium)
*Lower-dimensional gravity, DSSYK and group theory*

Abstract: In this talk, I will report on recent process in understanding lower-dimensional gravitational models structurally from group theory. The main strength of this approach seems to be its universality in describing different models. In particular, I will discuss how it can be used to argue for a bulk holographic dual of double-scaled SYK (DSSYK) in terms of sine dilaton gravity.

**15:00 - 15:30** – Coffee break

**15:30 - 16:30**
**Emilio Trevisani** (CNRS & Sorbonne Université)
*The Parisi-Sourlas Uplift and Infinitely Many Solvable 4d CFTs*

Abstract: Parisi-Sourlas (PS) supersymmetry is known to emerge in some models with random field type of disorder. When PS SUSY is present the d-dimensional theory allows for a $d-2$-dimensional description. In this paper we investigate the reversed question and we provide new indications that any given $CFT_{d-2}$ can be uplifted to a PS SUSY $CFT_d$. We show that any scalar four-point function of a $CFT_{d-2}$ is mapped to a set of 43 four-point functions of the uplifted $CFT_d$ which are related to each other by SUSY and satisfy all necessary bootstrap axioms. As a byproduct we find 43 non trivial relations between conformal blocks across dimensions.

We test the uplift in generalized free field theory (GFF) and find that PS SUSY is a powerful tool to bootstrap an infinite class of previously unknown GFF observables. Some of this power is shown to persist in perturbation theory around GFF.

We explain why all diagonal minimal models admit an uplift and we show exact results for correlators and CFT data of the 4d uplift of the Ising model. Despite being strongly coupled 4d CFTs, the uplifted minimal models contain infinitely many conserved currents and are expected to be integrable.

**10:00 - 11:00**

**Netta Engelhardt** (MIT, USA)

*Cryptographic Censorship: A Quantum Complexity Approach to (Quantum) Cosmic Censorship*

Abstract: Do naked singularities exist as typical states in quantum gravity? Various considerations, from black hole thermodynamics to empirical observations, suggest that the answer is no. Nevertheless, in the past decade, numerous generic solutions to GR in four spacetime dimensions have been found to be likely candidates for naked singularity formation. In this talk, I'll give evidence that such solutions are expected to be in the swampland, and give a theorem that, under certain assumptions, guarantees that event horizons do in fact exist in typical states in quantum gravity in the context of AdS/CFT.

**11:00 - 11:30** – Coffee break

**11:30 -12:30**

**Sean Hartnoll** (University of Cambridge, UK)

*Arithmetic Chaos Inside Black Holes*

Abstract: It has been known for over 50 years that spacetime dynamics becomes chaotic in the approach to singularities. Furthermore, the classical gravitational dynamics exhibits remarkable number-theoretic properties known as arithmetic chaos. I will review these facts and give an explicit realisation of these phenomena in the interior of an asymptotically AdS black hole. I will discuss possible implications for the nature of black hole singularities and black hole thermodynamics.

**12:30 - 14:30** – Lunch break

**14:30 - 15:30**

**Laura Donnay** (SISSA, Italy)

*Tracking celestial and Carrollian theories*

Abstract: In this talk, I will present recent developments towards formulating a holographic correspondence for asymptotically flat spacetimes. In particular, I will discuss the role of newly uncovered symmetries in the so-called celestial and Carrollian holographic proposals.

**15:30 - 16:00** – Coffee

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