MP 1: AdS-CFT I

Time: Monday 11:00–12:15 Location: H3

MP 1.1 Mon 11:00 H3

Geometry of Complexity in Conformal Field Theory — •Mario Flory[1] and Michał Heller[2] — [1]Instituto de Física Téorica IFT-UAM/CSIC, Universidad Autonoma de Madrid, 28049, Madrid, Spain — [2]Max Planck Institute for Gravitational Physics (Albert Einstein Institute), 14476 Potsdam-Golm, Germany

We utilize the Fubini-Study metric in order to define a notion of distance and hence circuit complexity on the Virasoro group. The resulting problem is mathematically equivalent to geodesic motion in infinite dimensions, with integro-differential equations of motion. We discuss the properties of these equations and of their solutions.

MP 1.2 Mon 11:25 H3

Realizing Computational Complexity in Conformal Field Theory — Johanna Erdmenger, Marius Gerbershagen, and •Anna-Lena Weigel — Julius-Maximilians-Universität Würzburg, 97074 Würzburg, Germany

An important question for the AdS/CFT correspondence is how the bulk geometry is encoded in the boundary field theory. A useful quantity proposed in this context is computational complexity. This is a concept adapted from quantum information that counts the minimum number of simple steps, gates, necessary to perform a calculation. While there exist concrete proposals for complexity in the AdS gravity theory, it remains an open question how to define it in a CFT. To make progress in this direction, a recent proposal suggests to restrict the allowed set of gates to symmetry transformations. This was employed to compute complexity for conformal transformations in 2d CFTs [1]. We generalize this approach to Kac-Moody symmetries and show that the complexity is equal to actions defined on coadjoint orbits of the according symmetry group. In this way, we calculate the complexity for several examples of CFTs [2]. The coadjoint orbit actions also arise from 3d gravity theory. We comment on connections between these gravity actions and complexity.

[1] P. Caputa, J. Magan. "Quantum Computation as Gravity". In: Phys. Rev. Lett. 122 (2019), p. 231302. arXiv:1807.04422 [hep-th].

[2] J. Erdmenger, M. Gerbershagen, A. Weigel. "Complexity measures from geometric actions on Virasoro and Kac-Moody orbits". In: JHEP 11 (2020) 003. arXiv:2004.03619 [hep-th].

MP 1.3 Mon 11:50 H3

Complexity as a holographic probe of strong cosmic censorship — Mohsen Alishahiha[1], •Souvik Banerjee[2], Joshua Kames-King[3,4], and Emma Loos[2] — [1]School of Physics, Institute for Research in Fundamental Sciences (IPM), Tehran, Iran — [2]Institut für Theoretische Physik und Astrophysik, Julius-Maximilians-Universität Würzburg, Würzburg, Germany — [3]Bethe Center for Theoretical Physics and Physikalisches Institut der Universitaet Bonn, Bonn, Germany — [4]Kavli Institute for Theoretical Physics, University of California, Santa Barbara, USA

Based on reasonable assumptions, we propose a new expression for Lloyd's bound, which confines the complexity growth of charged black holes. We then compute the holographic complexity for charged black branes in the presence of a finite cutoff using complexity = action proposal. Using the proposed Lloyd's bound, we find a relation between the ultraviolet and the behind the horizon cutoffs. This relation is found to be consistent with the factorization of the partition function at leading order in large N. We argue that the result may be thought of as a holographic realization of strong cosmic censorship.