LABORATORY FOR ELEMENTARY-PARTICLE PHYSICS (LEPP)

Theory Seminar

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Does holographic complexity satisfy Lloyd's bound?

It has been observed that the size of the interior of the AdS-Schwarzschild black hole keeps increasing linearly with time even after the scrambling time. The size of the black hole is defined by the value of the on-shell action of the Wheeler-DeWitt (WDW) patch. The fact that the computational complexity of a quantum state increases linearly with time led Susskind and collaborators to a general holographic conjecture that the growth of the complexity of the CFT state is holographically dual to the action of the WDW patch. Moreover, there are two more conjectures regarding holographic complexity. First conjecture, known as Lloyd's bound, states that the rate of change of complexity of a state is bounded from above by the instantaneous average energy of the state. The second conjecture states that the black holes saturate the Lloyd's bound for late times. Since then, there have been many examples where it was shown that Lloyd's bound is violated. In this talk, I will review these ideas and will argue that these examples do not necessarily are counterexamples to Lloyd's bound. Instead, these examples could alternatively be considered as the counterexample to the second conjecture stated above. After this, I will discuss an example where I study a time-dependent CFT state. I will argue that the holographic complexity of this state has UV divergences whereas the instantaneous energy is UV finite. This would imply that Lloyd's bound is violated for such a state. I will further argue that adding holographic counterterms to the action of the WDW patch will not solve the problem.

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2pm

401 Physical Sciences Building