Quantum Complexity Characteristics of Bulk Gravitational Singularities

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The theory of Quantum Information & Computation (QIC) is increasingly playing a key role in AdS/CFT, and holography in general, on uncovering how local bulk geometry is coded in quantum mechanical correlations of the dual quantum field theories. Computational Complexity of a quantum system, including CFT's, is one such concept from the QIC literature which has been touted by Susskind to play a crucial role in understanding black hole interior which is otherwise very hard to access through traditional CFT probes/observables such as correlation functions. This has led to the Complexity-Volumes (CV) and Complexity-Action (CA) conjectures, two new entries in the holographic dictionary which have been extensively studied in the recent literature. In the recent past work, we had looked at how bulk gravitational spacelike singularities show up in the complexity of the dual CFT state using the C-V and C-A conjectures and observed some broad features and some even more curious differences. In the present work, we turn our attention to some test cases of *timelike* singularities in the bulk, some old and some novel ones recently obtained by one of us in work related to EDM system in AdS/CMT context. We exclusively work with the CA conjecture, and compare our findings to some existing claims/statements about bulk timelike singularities in terms of the dual field theory (Gubser criterion).

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