

NEW PERSPECTIVES IN CONFORMAL FIELD THEORY AND GRAVITY

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Quantum Chaos and Complexity in Triangular Billiard Systems

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In light of recent advancements made towards quantifying quantum chaos in dynamical systems, and motivated by the search for viable definitions of complexity in quantum field theory and holography, we revisit quantum billiards and examine the recently proposed measure of Krylov state complexity known as spread complexity. In particular, we investigate the growth of Krylov state complexity in the system of triangular billiard systems with both rational and irrational angles, which we take to be the boundary of two-dimensional infinite potential boxes. While classically, these billiards exhibit zero Lyapunov exponent, quantum mechanically they display exponential growth of out-of-time-order-correlations (OTOC) and Krylov complexity. We further investigate higher moments of Krylov state complexity as well as new universality classes among them. Normally, the level spacing statistics follow Gaussian orthogonal ensemble statistics, but deviations caused by scarring and supscarring mechanisms occur. We further create a hierarchy of chaotic nature of these triangles by studying their growth of spectral complexity. This work has future directions of using new quantum chaos quantifiers to establish a quantum mechanical ergodic hierarchy, and may point towards new holography duals of complexity.

Summary

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