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Quantum chaos in a minimalistic supersymmetric Yang-Mills-like model: from graviton gas to black holes and black branes

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We consider a minimalistic supersymmetric quantum mechanical model with two bosonic and one fermionic degree of freedom, and a Hamiltonian that resembles that of a dimensionally reduced super-Yang-Mills theory. Low dimensionality of the model allows for an exact diagonalization study, which reveals surprisingly rich dynamics. Studying the energy level statistics, we identify three distinct regimes which closely resemble the graviton gas, the Schwarzschild black hole, and the black D0-brane regimes of the holographic dual of compactified 10-dimensional N=1 Super-Yang-Mills theory (BFSS model). All three regimes feature growing Out of Time Order Correlators (OTOCs) and appear to be indistinguishable in thermodynamics observables but exhibit very different behaviors of entanglement entropy.

The model provides an interesting testbed for first-principle studies of quantum chaos in Yang-Mills-like models.

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