

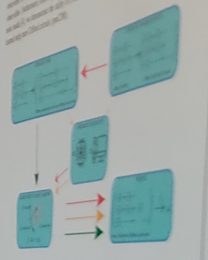


Simulating quench dynamics on a computer with data-driven error

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Introduction
The study of quench dynamics in quantum systems is a central topic in quantum information science. In this work, we study the dynamics of a quantum system after a sudden quench, focusing on the emergence of entanglement and the growth of entanglement entropy.

Theoretical model
We consider a system of N qubits, each with a local Hilbert space of dimension d . The system is initially in a product state and is then quenched to a new Hamiltonian. The evolution is governed by the Schrödinger equation.



Observables
We study the time evolution of the entanglement entropy $S(t)$ and the out-of-time-order correlator (OTOC). The OTOC is a measure of chaos and is related to the butterfly velocity.

Results
We find that the entanglement entropy grows linearly in time, with a slope that depends on the system parameters. The OTOC exhibits a characteristic butterfly pattern, indicating chaotic behavior.

Conclusions
Our results show that the dynamics of a quantum system after a quench is highly non-trivial and exhibits universal features. The data-driven error approach provides a powerful tool for studying such systems.

References
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[2] J. Eisert, M. Cramer, and M. B. Plenio, *Quantum Entanglement*, Wiley (2010).