

## **Regenesis and Quantum Traversable Wormholes**

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Recent gravity discussions of a traversable wormhole indicate that in holographic systems signals generated by a source could reappear long after they have dissipated, with the need of only performing some simple operations.

In this talk I will argue the phenomenon, to which I refer as "regenesi", is universal in general quantum chaotic many-body systems, and elucidate its underlying physics. The essential elements behind the phenomenon are: (i) scrambling which in a chaotic system makes out-of-time-ordered correlation functions (OTOCs) vanish at large times; (ii) the entanglement structure of the state of the system. The latter aspect also implies that the regenesi phenomenon requires fine tuning of the initial state. Compared to other manifestations of quantum chaos such as the initial growth of OTOCs which deals with early times, and a random matrix-type energy spectrum which reflects very large time behavior, regenesi concerns with intermediate times, of order the scrambling time of a system.

In this talk I will illustrate this phenomenon in detail in general two-dimensional conformal field theories in the large central charge limit, and highlight some interesting features including a resonant enhancement of regenesi signals near the scrambling time and their oscillations in coupling. Finally, I will discuss gravity implications of the phenomenon for systems with a gravity dual, arguing that there exist regimes for which traversability of a wormhole is quantum in nature, i.e. cannot be associated with a semi-classical spacetime causal structure.