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Abstract for an Invited Paper
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Oliver E. Buckley Condensed Matter Prize: Emergent gravity from interacting Majorana modes[1]

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I will describe a concrete many-body Hamiltonian that exhibits some features of a quantum black hole. The Sachdev-Ye-Kitaev model is a system of $N \gg 1$ Majorana modes that are all coupled by random 4-th order terms. The problem admits an approximate dynamic mean field solution. At low temperatures, there is a fluctuating collective mode that corresponds to reparametrization of time. The effective action for this mode is equivalent to dilaton gravity in two space-time dimensions. Some important questions are how to quantize the reparametrization mode in Lorentzian time, include dissipative effects, and understand this system from the quantum information perspective.

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