Summary: Acting on operators with a bare dimension $\Delta \sim N^2$ the dilatation operator of $U(N)$ $\mathcal{N} = 4$ super Yang-Mills theory defines a 2-local Hamiltonian acting on a graph. Degrees of freedom are associated with the vertices of the graph while edges correspond to terms in the Hamiltonian. The graph has $p \sim N$ vertices. Using this Hamiltonian, we study scrambling and equilibration in the large $N$ Yang-Mills theory. We characterize the typical graph and thus the typical Hamiltonian. For the typical graph, the dynamics leads to scrambling in a time consistent with the fast scrambling conjecture. Further, the system exhibits a notion of equilibration with a relaxation time, at weak coupling, given by $t \sim \frac{\rho}{\lambda}$ with $\lambda$ the ’t Hooft coupling.

MSC:
83E30 String and superstring theories in gravitational theory
83C57 Black holes
81R15 Operator algebra methods applied to problems in quantum theory
70S15 Yang-Mills and other gauge theories in mechanics of particles and systems

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AdS-CFT correspondence; black holes in string theory; gauge-gravity correspondence

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