

A Review of Sachdev-Ye-Kitaev Model and AdS_2/CFT_1

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ABSTRACT

The Sachdev-Ye-Kitaev model (SYK model for short) is a strongly interacting but solvable quantum mechanics model of N Majorana fermions with random interactions of a few fermions at a time. It is tractable in the large N limit, where the classical variable is a bilocal fermion bilinear. At low temperatures the system develops an emergent approximate conformal symmetry that is broken in a particular way. We study two and four point functions of the fundamental fermions. This provides the spectrum of the physical excitations for the bilocal field.

The emergent conformal symmetry is a reparametrization symmetry, which is spontaneously broken to $SL(2, R)$, leading to zero modes. These zero modes are lifted by a small residual explicit breaking, which produces an enhanced contribution to the four point function. This contribution displays a maximal Lyapunov exponent in the chaos region (out of time ordered correlator). The precise form of the symmetry breaking is the same as the one arising in simple dilaton gravity theories in AdS_2 . This fact makes the dynamics of the two systems similar. We expect these features to be universal properties of large N quantum mechanics systems with emergent reparametrization symmetry.

In this talk, I will start with introducing the SYK model and then move on to study the two and four point functions of the model. I will then talk about some variants (and generalizations) of the SYK model and try to make some comments on the dual of these theories.

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