Theorie Kolloquium
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Many body quantum chaos of the Sachdev-Ye-Kitaev Model

The Sachdev-Ye-Kitaev (SYK) model describes a system of a large number of randomly interacting Majorana fermions. It stands in the tradition of the random k-body interaction models pioneered in nuclear physics and later applied in condensed matter contexts. The SYK model can be looked at from three interrelated perspectives: a) a system showing many body chaos and random matrix correlations, b) a paradigm of strongly correlated (Majorana) quantum matter, and c) the holographic shadow of a two-dimensional AdS2 gravitational bulk. The interplay of these three has made it a focus of intensive research. Previous analytic work was restricted to the study of quantum correlations at time scales short compared to the inverse of the many body level spacing. In this talk, we address the complementary regime of large times. We will apply a matrix integral formalism to identify a set of collective modes in Fock space describing the relaxation of the system towards an ergodic long time limit. We will discuss universal signatures of these modes in spectral correlations, and compare our results to numerics. Finally, we will discuss the structure of the system's many body wave functions and point out differences to the wave functions of chaotic single particle systems.

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