



**UNIVERSITÄT  
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Faculty of Physics



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# Seminar

Bielefeld - Melbourne Random Matrices

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### RMT and path integral approaches to the SYK model and its entanglement entropy

The SYK model is a random  $q$ -fermion interacting model that is large- $N$  solvable. The model is physically interesting because it exhibits chaotic and non-fermi liquid behaviors and possesses a gravity dual description ( $q \geq 4$ ). In this talk I will present spectral properties of the SYK model from both random matrix and path integral points of view: the path integral formalism computes leading-order ( $1/N$ ) properties via saddle point equations efficiently, while the random matrix method readily computes the leading- and the subleading-order ( $1/N^2$ ) contributions. Interestingly, a new application of RMT is found in the study of the eigenstate entanglement entropy of the SYK model with  $q=2$ : the subsystem entanglement Hamiltonian of this random free fermion model belongs to the Jacobi  $\beta$ -ensemble. This is to be compared with the entanglement entropy of a random many-body eigenstate, whose reduced density matrix belongs to the Wishart ensemble. Finally, I explain how these results can be obtained via replica trick in the path integral formalism and discuss the possibility of formulating new RMT questions in the context of quantum systems.

**Wednesday, 09 September 2020, 0900 hrs CEST**

Zoom Konferenzschaltung— Please contact Anas Rahmann  
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