UNIVERSITÄT DUISBURG ESSEN

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Semiclassical foundation of universality in many-body quantum circuits

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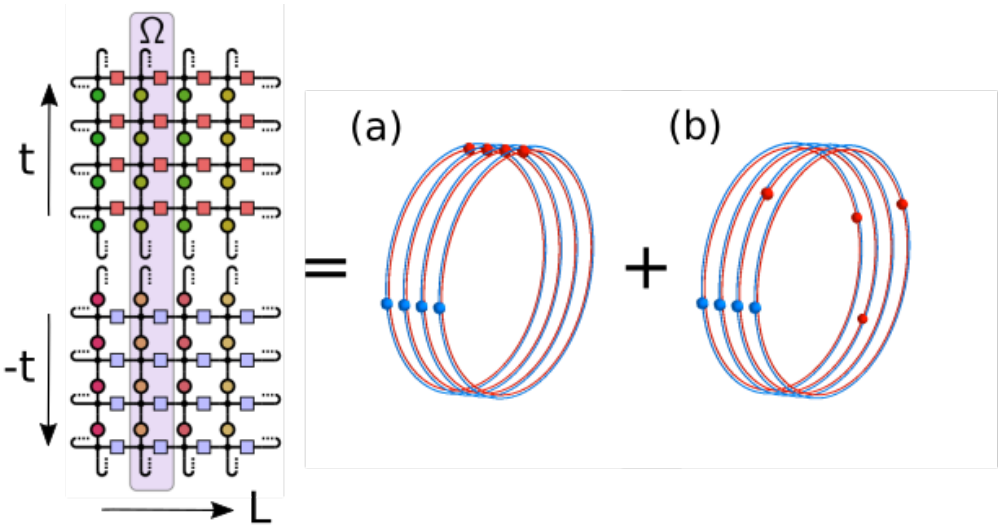

Fig 1: The spectral form factor of a quantum circuit (RHS) reduces in the semiclassical limit to a sum over periodic orbits of (a) globally synchronous periodic orbits and (b) asynchronous periodic orbits which are damped in time.

The detailed description of emergent random matrix behavior in quantum many-body systems is a central task in understanding the quantum chaotic/thermal phase in condensed matter physics. A foundational picture of this process is given from the quantum chaos perspective for single-particle systems by means of periodic orbit theory. Spectral statistics are thereby characterized in the semiclassical limit as correlations of classical periodic orbits. We will demonstrate a route for implementing periodic orbit theory in locally interacting many-body quantum circuits in form of a transfer matrix approach. We first focus on the spectral form factor and show that the emergent random matrix behavior can be understood as a synchronization of local symmetries towards a single global symmetry, see Fig. 1. Furthermore, we discuss the extension of the transfer matrix approach towards the partial spectral form factor and its connection to the eigenstate entanglement.