UNIVERSITÄT DUISBURG ESSEN

Offen im Denken

Theorie-Kolloquium WS 2021/22
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MC 351 & online (URL in E-Mail)

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Quantum Computing “al dente”

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From the perspective of many body physics, the transmon qubit architectures currently developed for quantum computing are systems of coupled nonlinear quantum resonators. In practice, one needs to balance intentional disorder / frequency detuning (to protect qubits) and nonlinear resonator couplings (to manipulate qubits) — but with chaos lurking to take over the many-body localized phase, will this be possible?

In this colloquium, I will provide quantitative answers to this question by discussing three independent diagnostics of localization theory — a Kullback-Leibler analysis of spectral statistics, statistics of many-body wave functions, and Walsh transform of the many-body spectrum — to characterize the current generation of quantum processors using untunable qubits (IBM type) and those using tunable qubits (Delft/Google type). Some of these turn out to be dangerously close to a phase of uncontrollable chaotic fluctuations.

Building a scalable quantum processor turns out to be surprisingly close to coming up with a perfect recipe for spaghetti “al dente” — a culinary perspective that we will gladly adopt for this colloquium.