



Contribution ID: 64

Type: **Poster.**

Quantum Magic via Perfect Sampling of Matrix Product States

We introduce a novel breakthrough approach to evaluate the nonstabilizerness of an N -qubits Matrix Product State (MPS) with bond dimension χ . In particular, we consider the recently introduced Stabilizer Rényi Entropies (SREs). We show that the exponentially hard evaluation of the SREs can be achieved by means of a simple perfect sampling of the many-body wave function over the Pauli string configurations. The MPS representation enables such a sampling in an efficient way with a computational cost $O(N\chi^3)$, no matter the Rényi index $n > 0$. The accuracy, being size-independent, can be arbitrarily improved with the number of samples. We benchmark our method over randomly generated magic states, as well as in the ground-state of the quantum Ising chain. Exploiting the extremely favourable scaling, we easily have access to the non-equilibrium dynamics of the SREs after a quantum quench.

Abstract category

Numerical Methods

Primary author: LAMI, Guglielmo (SISSA)

Co-author: Prof. COLLURA, Mario (SISSA)

Presenter: LAMI, Guglielmo (SISSA)