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Quantum Tea: Advanced tensor network methods for many-body physics

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The density matrix renormalization group was formulated three decades ago to compute the ground state of interacting one dimensional systems. Since then, tensor network methods have grown into an all-encompassing toolbox of algorithms for the low-energy physics of many body systems. This includes ground state search, evolution in real and imaginary time, dynamics of open systems, etc. Nowadays, most methods easily approach machine precision for simple cases, like quantum spin chains. However, tackling more realistic models, long-range interactions, higher dimensions, or geometric frustration requires a slightly more refined approach.

One possible avenue are tree tensor networks. They are constructed to capture more entanglement, and are thus useful for problems which are out of reach for standard matrix product states. I will broadly introduce these methods, present some recent results we obtained using tree tensor networks, and sketch what might be possible in the near future.

Theme

Theme 3. Theoretical and experimental methods for quantum effects in energy processes

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