New Tools for Simulating Realistic Systems with the Density Matrix Renormalization Group (DMRG)

Miles Stoudenmire
(UC Irvine)

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Abstract

The density matrix renormalization group (DMRG) is an extremely powerful technique for solving interacting many-body systems, but most applications of DMRG have been to lattice models on one-dimensional chains or ladder geometries. I will describe recent advances in DMRG that make it practical to explore richer classes of systems. In one dimension, we can now treat continuum models with long-range interactions with applications to electronic structure theory (especially density functional theory) and cold atom experiments. For two-dimensional systems, a new method for parallelizing DMRG means we can apply an order of magnitude more power to reach new system sizes. If time permits, I will also describe a promising extension of DMRG for finite temperature systems.