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Applications of projected entangled-pair states to two-dimensional spin systems BELA BAUER, Theoretische Physik, ETH Zurich, 8093 Zurich, Switzerland, GUIFRE VIDAL, School of Physical Sciences, The University of Queensland, QLD 4072, Australia, MATTHIAS TROYER, Theoretische Physik, ETH Zurich, 8093 Zurich, Switzerland — The density matrix renormalization group and the class of states it operates on, matrix-product states, have been widely accepted to be among the most powerful methods for simulations of one-dimensional quantum systems. They allow reliable approximations to the ground states of many quantum systems and have recently been extended to allow the simulation of time evolution and finite-temperature states. Generalizations to two-dimensional systems have therefore long been sought after. Several classes of tensor-network states that extend the concepts of matrix-product states to higher dimensions have been proposed. The common underlying property is that by construction, they capture the scaling of ground-state entanglement for large classes of systems and are therefore expected to approximate the properties of ground states accurately. In this presentation, we focus on a specific class of states, namely projected entangled-pair states on infinite lattices. We first assess the accuracy of these states for non-frustrated spin systems by comparing with Quantum Monte Carlo results. Furthermore, we present applications to frustrated quantum spin systems in two dimensions.

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