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Quantum Monte Carlo simulations with tensor-network states[1]
JEONG PIL SONG, R.T. CLAY, Mississippi State University — Matrix-product states, generated by the density-matrix renormalization group method, are among the most powerful methods for simulation of quasi-one dimensional quantum systems. Direct application of a matrix-product state representation fails for two dimensional systems, although a number of tensor-network states have been proposed to generalize the concept for two dimensions. We introduce a useful approximate method replacing a 4-index tensor by two matrices in order to contract tensors in two dimensions. We use this formalism as a basis for variational quantum Monte Carlo, optimizing the matrix elements stochastically. We present results on a two dimensional spinless fermion model including nearest- neighbor Coulomb interactions, and determine the critical Coulomb interaction for the charge density wave state by finite size scaling.

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