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Monte Carlo simulations of two-dimensional fermion models with string bond tensor-network states[1] JEONG-PIL SONG, EWHA Woman's Univ, R.T. CLAY, Mississippi State University — We present computational results using the string-bond tensor network ansatz for Fermionic lattice models in two dimensions. We use quantum Monte Carlo to calculate ground state quantities combined with stochastic optimization to optimize the matrix elements of matrix-product state strings. We apply the approach to a two-dimensional spinless fermion model with nearest-neighbor Coulomb repulsion under periodic boundary conditions. We test the numerical accuracy and convergence with matrix size D of the method with comparisons with the free fermion system, exact diagonalization results, and density matrix renormalization group results. The phase boundary between low entangled charge ordered and highly entangled metallic phases can be determined using finite size scaling of charge structure factor in the thermodynamic limit. Since this stochastic approach does not suffer from a fermion sign problem, it can handle frustrations and be applied to the Hubbard models with periodic boundaries in two dimensions.

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