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Accurate Determination of Tensor Network State of Quantum Lattice Models in Two Dimensions TAO XIANG, H.C. JIANG, Z.Y. XIE, Q.N. CHEN, Z.Y. WENG, Insitute of Physics, Chinese Academy of Sciences — We have proposed a novel numerical method to calculate accurately physical quantities of the ground state using the tensor network wave function in two dimensions. The tensor network wave function is determined by an iterative projection approach which uses the Trotter-Suzuki decomposition formula of quantum operators and the singular value decomposition of matrix. The norm of the wave function and the expectation value of a physical observable are evaluated by a novel second renormalization group method of tensors. Our method allows a tensor network wave function with a high bond degree of freedom to be handled accurately and efficiently in the thermodynamic limit. For the Heisenberg model on a honeycomb or square lattice, our results for the ground state energy and the staggered magnetization agree well with those obtained by the quantum Monte Carlo and other approaches.

Tao Xiang
Insitute of Physics, Chinese Academy of Sciences

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