Variational Monte Carlo simulations using tensor-product projected states

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We present a variational Monte Carlo method, which combines the advantages of recently developed tensor-product states and conventional trial wave functions. We apply a projector in the form of a tensor-product operator to an input wave function, such as a Jastrow-type or Hartree-Fock wave function, and optimize the tensor elements via variational Monte Carlo. Choosing an input state containing some features of the ground state can considerably reduce the bond dimensions required for the tensor-product projector, i.e. computational costs of the simulations. We use our method to investigate several many-body bosonic and fermionic systems on the square lattice, and demonstrate that the optimized states provide good approximations of the ground-state energy and correlation functions.