Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

A New Numerical Approach Toward MPS State on Spin Ladder Systems ZHENYUE ZHU, STEVEN WHITE — The matrix product state (MPS) representation used by DMRG is extremely effective in 1D, but loses effectiveness exponentially with the width in ladder systems. Tensor product wavefunction, such as PEPS, are efficient representations of 2D states but calculations utilizing them are very inefficient. As an intermediate approach between these, we consider a wavefunction consisting of an MPS multiplied by local bond exponentials $^{-}\tau H_{bond}$ applied on adjacent sites in the lattice which appear distant in the MPS. The exponentials restore the area law to the MPS. For efficient calculation, the bond-exponentials are transferred to the Hamiltonian in a matrix product operator representation, acting as a similarity transformation, preserving the eigenvalues. For this method to be successful, not only should the modified MPS representation be efficient, the MPO representation of the transformed Hamiltonian should have a small matrix dimension. We report on preliminary results on ladders with several legs for this approach.

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Date submitted: 28 Nov 2009 Electronic form version 1.4