# EFFICIENT MPS ALGORITHM FOR PERIODIC BOUNDARY CONDITIONS AND APPLICATIONS

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S u m m a r y

We present the implementation of an efficient algorithm for the calculation of the spectrum of one-dimensional quantum systems with periodic boundary conditions. This algorithm is based on a matrix product representation for quantum states (MPS) and a similar representation for Hamiltonians and other operators (MPO). It is significantly more efficient for systems of about 100 sites and more than for small quantum systems. We apply the formalism to calculate the ground state and the first excited state of a spin-1 Heisenberg ring and deduce the size of a Haldane gap. The results are compared to previous high-precision DMRG calculations. Furthermore, we study the spin-1 systems with a biquadratic nearest-neighbor interaction and show the first results of an application to a mesoscopic Hubbard ring of spinless fermions, which carries a persistent current.