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Spectral gaps of AKLT Hamiltonians using Tensor Network methods ARTUR GARCIA-SAEZ, C. N. Yang Institute for Theoretical Physics and the Department of Physics and Astronomy, Stony Brook University, VALENTIN MURG, Institute for Theoretical Physics, University of Vienna, Vienna, Austria, TZU-CHIEH WEI, C. N. Yang Institute for Theoretical Physics and the Department of Physics and Astronomy, Stony Brook University — Using exact diagonalization and tensor network techniques we compute the gap for the AKLT Hamiltonian in 1D and 2D spatial dimensions. Tensor Network methods are used to extract physical properties directly in the thermodynamic limit, and we support these results using finite-size scalings from exact diagonalization. Studying the AKLT Hamiltonian perturbed by an external field, we show how to obtain an accurate value of the gap of the original AKLT Hamiltonian from the field value at which the ground state verifies $e_0 < 0$, which is a quantum critical point. With the Tensor Network Renormalization Group methods we provide direct evidence of a finite gap in the thermodynamic limit for the AKLT models in the 1D chain and 2D hexagonal and square lattices. This method can be applied generally to Hamiltonians with rotational symmetry, and we also show results beyond the AKLT model.

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