Masaaki Nakamura: Exact results for a fermion chain with fractionalized excitations

Abstract:
We present a number of exact results for a fermion chain with center of mass conservation at $1/3$ filling. The ground state of our model, which is three-fold degenerate even in the case of site dependent interactions, show striking similarities with the superconducting BCS wave functions, the AKLT spin chain, and in particular, with the Laughlin state describing the fractional quantum Hall effect. This state supports exact zero modes with fractional charge slightly below 1/3 filling, and it has a matrix product representation which enables us to analytically calculate correlation functions, excitation gaps, and the entanglement spectrum. We further extend the present argument to general $1/q$ filling systems.

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